



6416Y2

A-Net Interface Card

User Guide

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PRO
64



Certifications

ETL/cETL Listed

EMC: EN 55013, EN 55020, SAA AS/NZS 1053

Conforms to: IEC 60065, EN 60065, UL 6500-2001

Certified to: CAN/CSA E60065, KETI

RoHS Status: Pb-free



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READ THIS FIRST

Important Safety Instructions



1. Read these instructions.
2. Keep these instructions
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or third prong are provided for your safety. If the provided plug does not fit your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit the apparatus.
11. Only use attachments/accessories specified by the manufacturer.



12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified personnel. Servicing is required when the apparatus has been damaged in any way, such as when the power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. No on/off power switches are included in the system. The external power supply should be used to control power to an Aviom device. This power supply should remain readily operable.
16. The solid line over dashed line symbol (————) indicates that the input voltage must be a DC voltage.
17. The box within a box symbol () indicates that the external power supply is double insulated.



WARNING!



TO REDUCE THE DANGER OF ELECTRICAL SHOCK DO NOT REMOVE COVERS.

NO USER SERVICEABLE PARTS INSIDE

REFER SERVICING TO QUALIFIED SERVICE PERSONNEL ONLY

To reduce the risk of fire or electrical shock, do not expose this product to rain or other types of moisture.

To avoid the hazard of electrical shock, do not handle the power cord with wet hands.

Replace fuse with same type and rating.

Operating Temperature: 10°C to 50°C (50°F to 122°F)

Risque de choc électrique – ne pas ouvrir. Pour réduire le risque de feu ou de choc électrique, ne pas exposer cet équipement à la pluie ou la moisissure. Pour réduire le risque de choc électrique, ne pas retirer le couvercle. Pièces non remplaçables par l'utilisateur. Confier la réparation à une personne qualifiée. Attention – utiliser seulement un fusible de rechange de même type.

Cet appareil est conforme à la section 15 de la norme FCC. Son fonctionnement est soumis aux conditions suivantes : (1) cet équipement ne doit pas causer des interférences nocives, et (2) cet équipement doit accepter toute interférence captée incluant les interférences pouvant causer des opérations indésirables.

Cet appareil numérique de Classe B est conforme à la norme NMB-003 du Canada.

CAUTION:

- Using any audio system at high volume levels can cause permanent damage to your hearing.
- Set your system volume as low as possible.
- Avoid prolonged exposure to excessive sound pressure levels.

IMPORTANT:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to the product not expressly approved by Aviom, Inc. could void the user's FCC authority to operate the equipment.

Aviom, Inc. Limited Warranty

Aviom, Inc. warrants this product against defects in materials and workmanship for a period of **one year** from the date of the original retail purchase.

This warranty does not apply if the equipment has been damaged due to misuse, abuse, accident, or problems with electrical power. The warranty also does not apply if the product has been modified in any way, or if the product serial number has been damaged, modified, or removed.

If a defect is discovered, first write or call Aviom, Inc. to obtain a Return Authorization number. No service will be performed on any product returned without prior authorization. Aviom, Inc. will, at its option, repair or replace the product at no charge to you. The product must be returned during the warranty period, with transportation charges prepaid to Aviom, Inc., 1157 Phoenixville Pike, Suite 201, West Chester, PA 19380. You must use the product's original packing materials for shipment. Shipments should be insured for the value of the product. Include your name, address, phone number, description of the problem, and copy of the original bill of sale with the shipment. The Return Authorization number should be written on the outside of the box.

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Warranty Information

Please record the following information for future reference:

Your Authorized Aviom Dealer:

Name: _____

Address: _____

Phone: _____

Serial Numbers of Your Aviom Products: _____

Date of Purchase: _____

Your Authorized Aviom Dealer is your primary source for service and support. The information recorded above will be helpful in communicating with your Authorized Aviom Dealer should you need to contact Aviom Customer Service. If you have any questions concerning the use of this unit, please contact your Authorized Aviom Dealer first. For additional technical support, or to find the name of the nearest Authorized Aviom Repair Station, check the Aviom web site at www.aviom.com.

To fulfill warranty requirements, your Aviom product should be serviced only at an authorized Aviom service center. The Aviom serial number label must appear on the outside of the unit, or the Aviom warranty is void.

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Although every effort has been made to ensure the accuracy of the text and illustrations in this manual, no guarantee is made or implied as to the accuracy of the information contained within.



Warning

Failure to observe the following warnings may lead to risk of serious injury from fire or electric shock.

Before installing the 6416Y2 card, you must refer to the owner's manual of the host device or to the Yamaha website to verify that your host device supports this card, and to verify the number of cards that can be installed in combination with other Yamaha or third-party cards.

- Do not attempt to disassemble or modify the card. Do not apply excessive force to board connectors or other board components. (Mishandling the board may lead to shock, fire hazard, or equipment failure.)
- You must turn off the power of your device before you begin installing the 6416Y2 card.
- Be sure to disconnect the power cable from the main unit before installing this card (to eliminate shock hazard).



Caution

Failure to observe the following precautions may lead to personal injury, or may result in damage to equipment or other property.

- Do not touch the board's metallic leads (pins) when handling the card. (Pins are sharp and may cause hand cuts.)
- The card is electrostatic-sensitive. Before handling the card, you should briefly touch the main unit's metal casing with your bare hand so as to drain off any static charge from your body.

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Welcome

Thank you for purchasing the **6416Y2 A-Net® Interface Card** for use with Yamaha® digital products that support the mini-YGDAI (MY) card format. This User Guide is designed to familiarize you with the features and functions of your new Pro64® product. All Pro64 products are powered by A-Net®, Aviom's proprietary data transmission protocol designed especially for the unique demands of live streaming audio.

In developing the Pro64 Series, we have made every effort to make the user interface as easy to use and understand as possible. We encourage you to read the manual completely, as some of the powerful features of your new product may not be immediately apparent.

Package Contents

Check the contents of the shipping box carefully before making connections and continuing with installation.

The contents of the 6416Y2 A-Net Interface Card box includes:

- One 6416Y2 A-Net Interface Card
 - User documentation
- ✓ **NOTE** Retain the protective bag that encloses the 6416Y2 card. The card is static-sensitive. Use the bag whenever the card will be transported without being installed in a Yamaha device.

Features

The 6416Y2 A-Net Interface Card is a 16-channel Pro64 A-Net I/O expansion card for Yamaha's digital devices including digital mixing consoles and the Digital Mix Engine™ (DME) products. It provides a host of professional features designed to make audio networking with Pro64 Series products easy to set up and configure in a variety of professional audio situations.

6416Y2 A-Net Interface Card Features:

- Compatible with Yamaha mini-YGDAI (MY) expansion card format
- Sixteen input and output channels (*Note: 8 channels only on the PM1D console*)
- Inputs from the console can be individually activated into the Pro64 network
- A-Net base slot range can be independently set for inputs and output banks

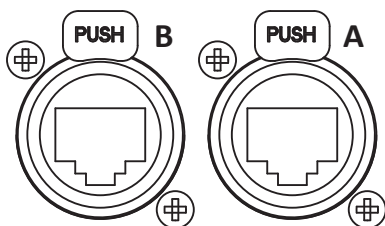
- The 6416Y2 card can be both the Pro64 network Control Master and the network Clock Master
- Flexible and robust clocking allows simple console-to-console digital connections
- Front-panel Stereo Link DIP switches for channel pairing for use with Pro16® Personal Mixers
- Two Pro64 A-Net network ports
- EtherCon® RJ45 network connectors
- Support for Pro64 Virtual Data Cables™ (VDC)
- Variable sample rates: 44.1/48kHz or 88.2/96kHz
- RS-232/422 Virtual Data Cable I/O (compatible with the Yamaha remote control protocol)
- Multiple cards can be installed per console or DME
- m-control™ allows remote control of 6416m Mic Input Module preamp settings directly from the Yamaha user interface

The EtherCon Connector

Pro64 Series products feature locking connectors for all network I/O. The Neutrik® EtherCon® connector is a dual RJ45-type connector that can receive a standard Category 5e cable or a cable fitted with the special locking EtherCon connector.

When using a standard Cat-5e cable, plug the cable into the center of the EtherCon jack; release the cable by pressing on the small plastic tab built into the cable connector.

The locking EtherCon connector is similar to an XLR plug, the kind commonly used on microphone cables. Insert an EtherCon-equipped cable into the jack until it clicks and locks in place. To remove the cable, press on the metal release tab at the top of the panel-mounted EtherCon jack and pull the connector outward.



The 6416Y2 has two A-Net ports, labeled A and B.

Cat-5e Cables

All Cat-5e connections between A-Net devices should use Unshielded Twisted Pair (UTP) cable. The cable can be of the stranded or solid type; solid wire performs better over long distances, while stranded wire is more flexible and easier to manipulate and therefore easier to work with in a live performance situation.

Cables designated as Cat-5e in Pro64 documentation can be interchanged with any Cat-6 (or better) cable. Cables will be referred to simply as "Cat-5e."

Connectors on Cat-5e cables used with Pro64 devices can be of the standard RJ45 variety or locking Neutrik EtherCon type.

DIP Switches

Illustrations of Pro64 DIP switch components in this document will indicate the switch handles in black.



In this diagram, all DIP switches are in the down position.

Cleaning

Before cleaning a Pro64 product, turn off the power switch and unplug the unit from the AC power source.

To clean the surface of the Pro64 product use a clean, soft lint-free cloth that has been slightly moistened with water only. For tougher dirt, use a cloth slightly dampened with water or with a mild detergent. Always be sure to dry the surface of the unit before proceeding with use.

When cleaning your Aviom products, never spray cleaners directly onto the product surfaces. Instead, spray a small amount of the cleaning solution onto a clean cloth first. Then use the dampened cloth to clean the product.

Never use solvents or abrasive cleaners on the finished surfaces of your Aviom products.

Compatibility

The Aviom 6416Y2 A-Net Interface Card is compatible with the following Yamaha devices:

Device	Mini-YGDAI (MY) Expansion Slots	Maximum 6416Y2 Cards	m-control
AW2816	1	1	
AW4416	1	1	
AW2400	1	1	
O1V96	1	1	
O2R96	4	4	
DM1000	2	2	√
DM2000	6	5	√
DME24N	2	2	√
DME64N	4	4	√
PM5D/PM5D-RH	4	4	√
DSP5D	2	2	
PM1D (8 channels)	8	8	
M7CL-32	3	3	√
M7CL-48	3	3	√
LS9-16	1	1	√
LS9-32	2	2	√

The Pro64 6416Y2 A-Net Interface Card can used with the Pro16 Y1 A-Net Interface Card simultaneously as long as the Yamaha device has available MY expansion slots.

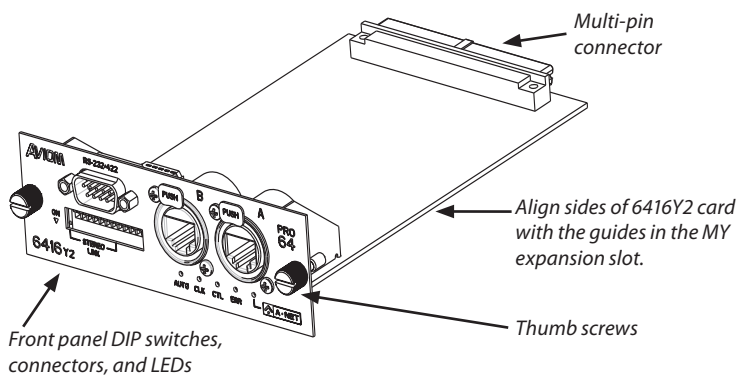
Installing the 6416Y2 Card

Before installing the 6416Y2 card in a compatible Yamaha digital device, be sure to read the DIP switch configuration section of this User Guide (page 30).

The 6416Y2 card can be used in any MY (mini-YGDAI) expansion slot in a Yamaha digital mixing console or compatible digital product (see the list on page 3). The specific number of available expansion slots varies with each model. Yamaha expansion slots are identified by number, starting with "Slot 1." Within an MY expansion slot, its audio resources are referred to as "channels," numbered from 1 to 16 in the Yamaha interface. (The PM1D is limited to 8-channel operation.)

- ✓ **NOTE** The 6416Y2 card is electrostatic-sensitive. Before handling the card, you should briefly touch the host unit's metal casing with your bare hand to drain off any static charge from your body.

The components of the card are indicated in the diagram below.



- ✓ **NOTE:** Some Pro64 network and audio routing settings cannot be changed once the card has been connected to the Yamaha device since they are changed via DIP switches found on the circuit board of the card itself.

To install the 6416Y2 card:

- Start with the power to the Yamaha digital device **off**.
- Remove the Yamaha device's power cord from the wall receptacle.
- Remove the cover plate on the Yamaha device's expansion slot to expose the expansion connections.
- Discharge any built-up static charge by touching the metal casing of the host Yamaha unit.
- Remove the 6416Y2 card from its protective anti-static sleeve.
- Ensure that the 6416Y2 card DIP switches are set properly for your application at this time.
- Slide the 6416Y2 card into place, aligning the sides of the card with the support guides in the MY expansion slot.
- Press the 6416Y2 card firmly in place to attach the multi-pin connectors on the card to those on the expansion slot backplane on the Yamaha device.
- Tighten the thumb screws on the 6416Y2 to secure it.
- Power up the Yamaha digital device.
- Connect the 6416Y2 to a Pro64 network.

Once the Aviom expansion card has had its DIP switches configured and is installed in the Yamaha host device, all audio routing to/from the 6416Y2 A-Net Interface Card is done from within the Yamaha device's user interface. Consult the documentation that came with your Yamaha product for more specific signal routing information.

✓ **NOTE:** Always power off the Yamaha host device before removing the 6416Y2 card.

Installing Multiple 6416Y2 Cards

A Yamaha host device can support as many Pro64 A-Net cards as it has available MY (mini-YGDAI) expansion slots and internal power resources. When multiple 6416Y2 A-Net Interface Cards are installed in a Yamaha host device, each 6416Y2 card needs to be connected via its A-Net ports to the Pro64 network. Simply use a short Cat-5e jumper cable to interconnect the 6416Y2 cards.

A list of compatible Yamaha products and the number of available MY expansion slots on each appears on page 4.

Firmware Notice

All Pro64 devices in a network should be updated to use the most recent firmware version to ensure trouble-free operation.

As new Pro64 modules are released, older Pro64 products need to be updated so that they recognize the features and functions of the newer modules—something that is especially important if one of the older devices will be used as the network's Control Master. (If for some reason you cannot update the firmware on older Pro64 devices before using them, set the newest module to be the network Control Master.)

Pro64 Update Tool is a free Windows software application for updating the operating firmware in Pro64 Series products.

The Pro64 Update Tool requires a direct RS-232 (serial) connection between the computer and the Control Master device on the Pro64 network. Normally this is accomplished by connecting a null modem DB9 cable between the RS-232 jack on the computer and the Pro64 device. Complete information on using RS-232 (and USB-to-RS-232 adapters) is available on the Aviom website. Updates take just a few minutes per module.

Pro64 Update Tool is designed to run on a PC under Microsoft® Windows® XP. It has also been tested and found to be compatible with Microsoft Windows Vista®. Mac users can run Pro64 Update Tool using Windows XP running under Apple's Boot Camp program on Intel-based Macs.

Get the Pro64 Update Tool and firmware update files from the Aviom website: <http://www.aviom.com>

AC Power

The following applies to the host device that the 6416Y2 A-Net Interface Card is installed in.

Always plug the unit into a properly grounded (earthed) outlet. Always use the AC line cord that was shipped with the unit. Grasp the power cable by the connector and never by the cord itself when connecting and disconnecting it from the power source.

Do not expose the Pro64 device to moisture, rain, or excessively damp environments.

AC Line Conditioning

Aviom products are digital devices and as such are sensitive to sudden spikes and drops in the AC line voltage. Changes in the line voltage from lightning, power outages, etc. can sometimes damage electronic equipment.

To minimize the chance of damage to your equipment from sudden changes in the AC line voltage, you may want to plug your equipment into a power source that has surge and spike protection. Power outlet strips are available with built-in surge protection circuits that may help protect your equipment.

Other options for protection of your equipment include the use of an AC line conditioner or a battery backup system (sometimes referred to as an *uninterruptible power supply*, or UPS).

Ventilation

Always allow adequate ventilation for devices mounted in equipment racks. Avoid placing your Pro64 product directly above or below other rack-mounted devices that produce high levels of heat, such as power amplifiers.

Cleaning

Before cleaning a Pro64 product, turn off the power switch and unplug the unit from the AC power source.

To clean the surface of the Pro64 product use a clean, soft lint-free cloth that has been slightly moistened with water only. For tougher dirt, use a cloth slightly dampened with water or with a mild detergent. Always be sure to dry

the surface of the unit before proceeding with use.

When cleaning your Aviom products, never spray cleaners directly onto the product surfaces. Instead, spray a small amount of the cleaning solution onto a clean cloth first. Then use the dampened cloth to clean the product.

Never use solvents or abrasive cleaners on the finished surfaces of your Aviom products.

About A-Net



Aviom’s A-Net® is the only networking technology conceived, designed, and optimized for managing and distributing audio using ordinary Cat-5e cables. As implemented in the Pro64® Series products, A-Net can transmit up to 128 channels of uncompressed 24-bit audio with the reliability and fidelity of analog, and the power and flexibility of a true digital network.

Pro64 A-Net allows variable sample rates in three ranges, from 44.1kHz± to 192kHz±, with ultra-low latency, jitter, and wander. Pro64 devices can be connected in any combination of serial (daisy-chain) or parallel (star) topologies. Cable runs between Pro64 devices can be up to 400 feet (120 meters) on Cat-5e¹, and miles on single- or multi-mode fiber optics (using Aviom fiber-capable equipment such as the MH10f).

Because A-Net is designed specifically for audio, the technological limitations of Ethernet and Ethernet-based products are removed, while audio performance and system flexibility are increased. A-Net incorporates Aviom’s unique patented and patent-pending algorithms for controlling clock jitter and wander, as well as system-wide latency—regardless of an installation’s size, design, or clocking setup. A-Net offers significant advantages in fidelity, performance, and flexibility over Ethernet-based products.

A-Net uses the “physical” layer of Ethernet, but it eliminates all the protocol elements that are designed for computers and IT-style networking. In audio applications, these other layers reduce efficiency, impose system restrictions, and introduce latency and timing instability. By eliminating Ethernet data structures, A-Net creates a superior network, with enhanced audio performance. With A-Net and the Pro64 Series, Aviom continues to break new ground in the design and development of innovative digital audio networking technologies and solutions.

Pro64 Series Supported Sample Rates		
Sample Rate	Minimum	Maximum
1x 44.1/48kHz	39.7kHz	52kHz
2x 88.2/96kHz	79.4kHz	104kHz
4x 176.4/192kHz	158.8kHz	208kHz

Clocking

The Pro64 network offers the most flexible clocking and synchronization options in the industry. Pro64 devices support three ranges of variable sample rates, from 44.1/48kHz± to 192kHz±. Because no sample rate converters are

1 Cat-5e, Cat-6, or better, Unshielded Twisted Pair (UTP) cable

used, audio transmission is kept fast and clean, eliminating the audio artifacts and signal degradation inherent to sample rate conversion—even when syncing to an external clock source.

Any Pro64 I/O module can be designated the clock master for the network, generating and distributing its internal clock. Digital I/O modules are capable of syncing to and distributing an external word clock.

Control Data

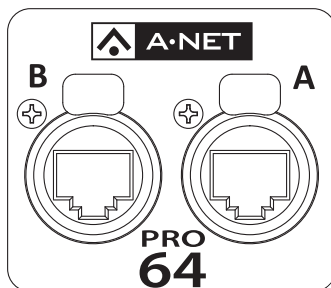
The Pro64 Series has built-in, dedicated bandwidth for 14 channels of non-audio control data through the use of Aviom's innovative Virtual Data Cables™ (VDC). These data streams are always available to carry MIDI, RS-232/RS-422, or GPIO (General Purpose I/O), and they never compete with the audio channels for network resources, regardless of the system configuration.

Because VDC inputs are simply incorporated into the A-Net stream, these control signals can be transmitted over very long cable runs and even across an entire Pro64 network, significantly expanding the applications possible with MIDI, RS-232/RS-422, and GPIO. And as with audio signals, VDC control data can be input anywhere and output anywhere else in the network.

The exact complement of VDC I/O connectivity varies per product.

A-Net Ports

Pro64 I/O modules have dual A-Net ports, labeled A and B. Both ports carry a bidirectional A-Net stream at all times. (That is, both ports are always transmitting *and* receiving A-Net data.) Pro64 networks can be configured in one of two operational modes, Auto Mode or Manual Mode, depending on the requirements of a particular application.



Each A-Net port carries bidirectional data at all times.

In Auto Mode, there are no connection rules; connect a Cat-5e cable to either the A or B port and the network does the rest. Auto Mode provides a true audio network with 64 available “Slots” for transporting audio (at 44.1/48kHz). Every audio Slot is available everywhere in the network, with no upstream/downstream restrictions.

In Manual Mode, the Pro64 network becomes a 64x64 system (at 48kHz), similar to a traditional stage-to-FOH snake. At every point in the Manual Mode network, two 64-channel streams are available on the cable and in each module. The configuration of the cables and ports has an impact on the makeup of the network and the distribution of audio signals. The user can direct A-Net data from a Pro64 input module to a specific port (A, B, or both). Likewise, Pro64 output modules can be configured to output audio signals received from a specific Pro64 network port (A or B).

Support For Pro16 Series Products

Pro64 Series products can be combined with Pro16® Series output products such as the Pro16 Monitor Mixing System by adding the Pro64 ASI A-Net Systems Interface. This 1U module converts Pro64 data to Pro16 data, providing up to four 16-channel streams of data (depending on the Pro64 sample rate) that can be used with A-16II and A-16R Personal Mixers, A-Net Distributors, and AN-16/o Output Modules.



The ASI is not compatible with the A-Net output of Pro16 input modules such as the AN-16/i and AN-16/i-M and console interface cards such as the Y1.

Pro64 User Interface

This section outlines some basic concepts of operation for Pro64 products. Pro64 I/O devices have some common user interface elements that make setting up an audio network easy to understand. Although the 6416Y2 is set up using DIP switches, its interface elements are similar to other Pro64 hardware I/O modules that use buttons and LEDs for comparable features (seen in some of the examples). Any combination of Pro64 devices can be used when setting up a Pro64 network.

A-Net Slot

Pro64 I/O devices come in a variety of configurations. To allow a large number of hardware audio input devices to be available to the Pro64 audio network, Aviom has implemented the concept of the A-Net Slot to simplify the configuration of potentially complex audio networks. Simply put, an A-Net Slot is a place in the network where an audio input resource (analog or digital) is assigned.

A Pro64 network will always have a finite number of A-Net Slots available that can be addressed by an unlimited number of hardware channels. The actual number of available Slots is determined by the current sample rate.

Slots versus Channels

You might be wondering why Aviom chose to refer to the audio I/O resources in the Pro64 Series products as “Slots.” Why not just call them “channels”?

We did this to avoid confusion between references to physical *hardware* audio resources and virtual *network* audio resources. The word “channel” is ambiguous and may cause confusion when configuring an audio network. “Channel” appears in many contexts, including audio mixing consoles, mic preamps, DSP processors, and DAW software.

We use the word “channel” when referring to the *physical* audio inputs— analog or digital—on a piece of hardware (such as the 16 line-level XLR input jacks on the 6416i Input Module or a Yamaha console resource such as a direct output or aux bus send). Each of these audio input sources can be made active and added to the network individually, and it is only when *activated* that they use any network resources (the A-Net Slots). To allow this functionality, Pro64 products separate the hardware resources from the available network resources by giving each hardware input channel a switch or button that allows it to be added to the network as needed. (The 6416Y2 card uses DIP switches.)

It is these activated hardware resources that are being referred to as “Slots.”

Pro64 audio networks can potentially have a greater number of audio channels and hardware I/O devices connected than the network can make use of at one time. This provides flexibility without requiring constant re-patching.

Keep in mind that a Pro64 A-Net network can only manage a specific number of Slots at a time, and this number varies with the sample rate being used. The maximums are 64 Slots in Auto Mode at the 48kHz sampling rate and 64x64 Slots in Manual Mode at 48kHz.

In summary, think of “channels” as hardware resources that can be added to the network as needed and “Slots” as locations within the Pro64 digital audio network pipeline that A-Net uses to move data throughout the network.

Slots and Sample Rate

The current system-wide sample rate will determine the number of A-Net Slots that are available. Auto Mode and Manual Mode have the same number of Slots at each sample rate; only the direction of the data is different.

Sample Rate	A-Net Slots	Yamaha Compatibility
44.1kHz	64	Yes
48kHz	64	Yes
88.2kHz	32	Yes
96kHz	32	Yes
176.4kHz	16	No
192kHz	16	No

Even though the network sample rate may change the available number of A-Net Slots, the I/O capacity of a hardware device does not change. That is, a 16-channel input module in a 96kHz network can still have all of its channels activated; all of its physical inputs can operate at 96kHz.

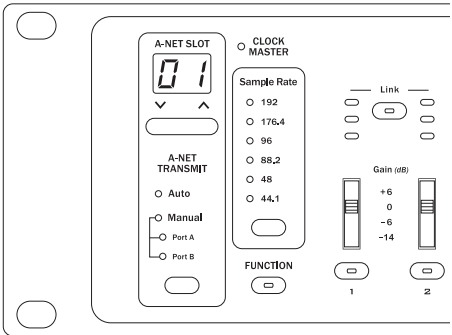
The current sample rate will also affect the display of available A-Net Slot ranges. Slot ranges will always have the same maximum number as seen in the sample rate chart. At 96kHz, for example, only Slots 1 through 32 are available; the Slot range from 33 to 64 is inactive and unavailable at 96kHz.

Slot ranges outside the maximum for the current sample rate can be selected, but attempting to activate a channel in an unavailable range will result in an error message on hardware I/O modules (the selected channel button, A-Net Slot range, and sample rate LEDs will all flash). Note that console interfaces such as the 6416Y2 card have no A-Net Slot displays and cannot display these error messages.

A-Net Base Slot

Since the capacity of the Pro64 network could be as high as 64 A-Net Slots, Pro64 hardware I/O devices need a way of routing a selected hardware channel to a desired network Slot. The 6416Y2 uses DIP switch block SW9 to select a base Slot range, in groups of 16 channels. There is no Slot display. See page 39 for more info on A-Net Slot setup.

For Pro64 hardware I/O devices, the upper left corner of the front panel contains a dedicated A-Net Slot display. Its associated inc/dec buttons are used to select a range of Slots that the hardware device will address.



The A-Net Slot display and its inc/dec buttons are used to set the base Slot for a Pro64 I/O module. An input module is shown here.

The following table shows the channel-to-Slot correlation for 16-channel Pro64 Series modules in a network running at the 48kHz sample rate. The numbers in the Base Slot column will appear in the A-Net Slot display of all I/O modules (the 6416Y2 has no Slot display).

16-Channel Pro64 Module Hardware Channels																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Base Slot	A-Net Slot															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64

The use of Slot assignments allows for easy reconfiguration of audio networks and sharing of hardware I/O resources and data without physical re-patching.

A-Net Slot Example

The following example shows the power of the Pro64 network and the A-Net Slots concept.

The range of A-Net Slots used in the example has been limited to the group from 1 to 16 for simplicity.

This graphic represents a Pro64 product set to use Slot range 1.

Slot	Channel															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

One 16-channel input module is placed in each of four rooms of a production facility, designated as Studios A, B, C, and D. One 16-channel output module is installed in the facility's Studio E. All modules are set to Slot range 1 (shown in grey).

Studio A Inputs																
Slot	Channel															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Studio B Inputs																
Slot	Channel															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

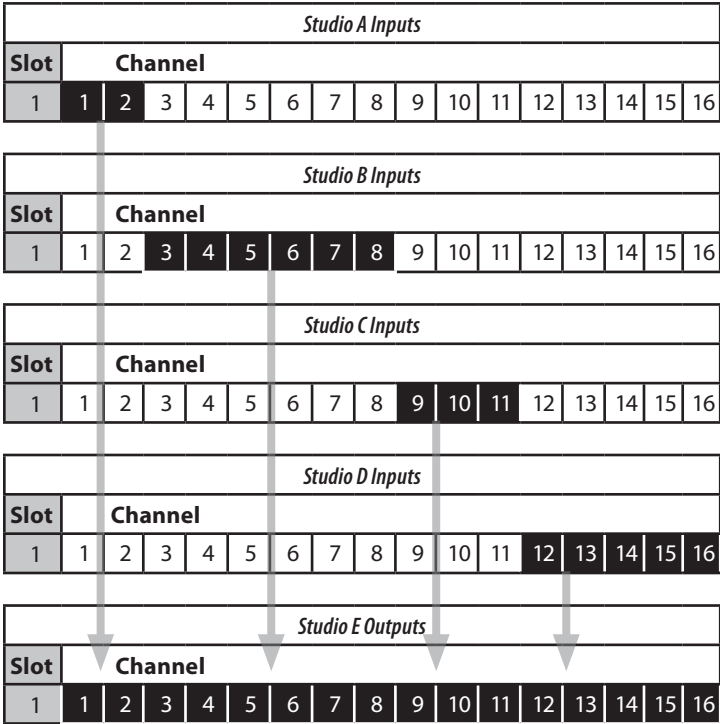
Studio C Inputs																
Slot	Channel															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Studio D Inputs																
Slot	Channel															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Studio E Outputs																
Slot	Channel															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

By activating a few channels on each of the four input modules, a total of sixteen inputs (Slots) are used, indicated by reverse text. All of these inputs are available throughout the Pro64 network at every output module— analog, digital, Yamaha card, etc. The operator in Studio E can use the sixteen sources from Studios A, B, C, and D simultaneously.

The order in which the Pro64 devices are connected is irrelevant.



Network Modes

A Pro64 audio network can be set to operate in one of two modes, Auto or Manual. The network mode can be selected on the front panel of the I/O device designated as the system’s Control Master or from the DIP switches in block SW9 if the 6416Y2 card is set to be the Control Master. See page 39 for more info on A-Net Slot setup.

Both modes are fully bidirectional at all times, regardless of the system layout or design.

Auto Mode

Pro64’s Auto Mode takes most of the work out of managing resources in an audio network. This is the “everything everywhere” mode. Input channels made active in the network can be seen and used by all devices in the network, regardless of how the modules are connected and regardless of the physical location of any module. Output modules do not need to follow input modules as in a traditional analog system. In Auto Mode, both A-Net ports (A and B) function identically.

Once configured for Auto Mode, the system ensures that only one hardware input channel is activated into a given A-Net Slot. There is no limit to the number of output channels that can use a given A-Net Slot—unlimited digital splits. The actual number of available Slots is determined by the current sample rate. The maximum number of available Slots (active input channels) is 64 at the 44.1/48kHz sample rate.

Sample Rate	Available A-Net Slots in Auto Mode
44.1/48kHz	64
88.2/96kHz	32
176.4/192kHz	16

✓ **NOTE:** Sample rates above 96kHz are not compatible with Yamaha devices.

Manual Mode

When more than 64 channels are needed in a network or digital snake, Manual Mode can be used to provide configurations of up to 64x64 channels. Two unique 64-channel streams are available at each module. In Manual Mode, the A and B A-Net port connections can be used to direct and route A-Net data.

Pro64 input modules can send their audio inputs to either or both A-Net ports, while output modules can listen to data from either port. For a traditional stage-to-FOH snake system, this allows the user to configure a

system with up to 64 sends from the stage and another unique stream of up to 64 returns to the stage.

Manual Mode operation removes the restrictions of unique channel-to-Slot-range relationships found in Auto Mode. Slots can be overwritten, allowing the user to replace channels from one part of the network with new data. This means that, while no more than 128 total Slots can be active in the network at a particular location, there is no practical limit to the total number of audio channels in the system.

The number of available Slots in Manual Mode is dependent upon the current sample rate.

Sample Rate	Available A-Net Slots in Manual Mode
44.1/48kHz	64x64
88.2/96kHz	32x32
176.4/192kHz *	16x16 *

** The Pro64 network's 176.4 and 192kHz sample rates are not compatible with Yamaha devices.*

Control Master

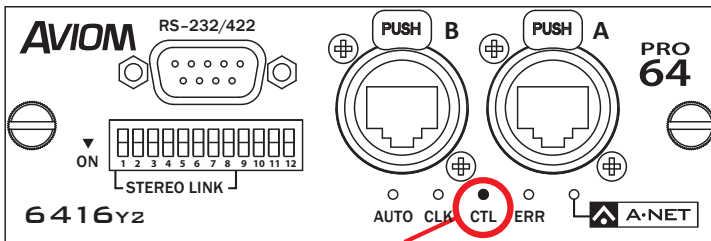
In every Pro64 network, one device will always be designated as the Control Master, the device that manages all A-Net resources for the network. The Control Master can be any I/O module in the network, and can be assigned or changed by the user as needed. Only one device can be assigned as Control Master in a Pro64 network at a time; an A-Net Pro64 network cannot function without a Control Master.

The functions of the Control Master include:

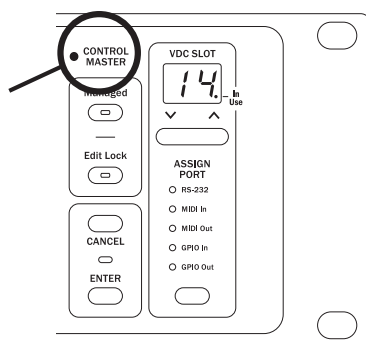
- System resource and information management
- Setting network mode (Auto or Manual)
- Management of active channels (Slots) in Auto Mode
- System-level command and control functions
- Keeping track of all Pro64 devices in the network (by type and quantity)
- Control of the current system-wide sample rate
- Clock Master (analog modules only)
- System lock via password on/off
- Management of Virtual Data Cable (VDC) resources
- Management of stereo link status
- Requests to enter Managed Mode

The Control Master status is identified with a red LED on the front panel of the device currently assigned as the Control Master. Depending on the type of device (rack-mounted I/O module or console interface card), the method used for designating Control Master status may be different.

The Control Master LED is labeled CTL on the 6416Y2 card.



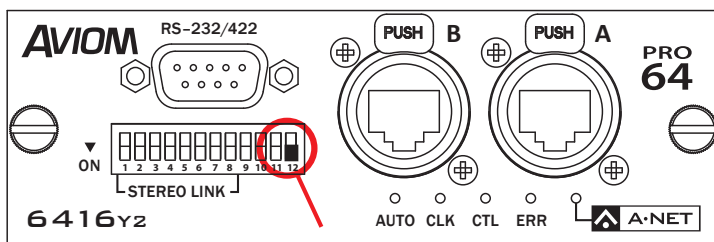
The Control Master LED (abbreviated as "CTL") on the 6416Y2 card



Only one device in a Pro64 network can be designated as the Control Master. Here, a Pro64 I/O module is shown.

Setting Control Master Status

Setting the 6416Y2 to be the network Control Master is done using the DIP switches found on the front panel. The Control Master is set with switch 12, found in the same DIP switch block as the Stereo Link section of the interface.



DIP switch 12 (shown in black) is used to set the Control Master status for a 6416Y2 card.

Move DIP switch 12 to the down position to make the 6416Y2 card the Pro64 network Control Master.

- ✓ **Note:** When a 6416Y2 card is set to be Control Master, it is automatically set to be the Clock Master. The clock comes from the Yamaha device in this case.

Control Master Functions

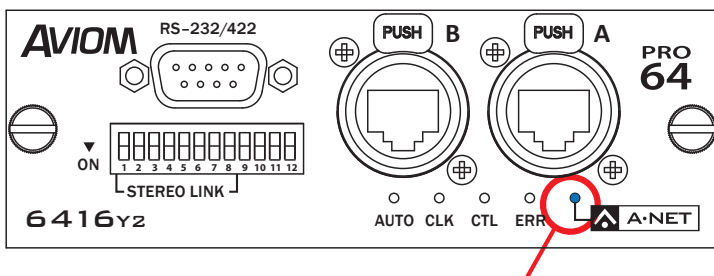
This section describes the individual functions of the Control Master device in a Pro64 network.

Enumeration

When the Control Master is powered on, its first job is to identify and count all connected A-Net modules in the network in a process called *enumeration*. The time for this process will vary based upon the number of Pro64 modules in a system. This process cannot begin until the host Yamaha device has finished its own power-up cycle when a 6416Y2 A-Net Interface Card is the Control Master.

Enumeration is an automated process performed by the command and control portion of the A-Net software. There are no user-controllable functions or settings.

During the enumeration process, all connected A-Net modules will flash their blue A-Net LEDs, indicating that a request to be added to the Pro64 network is being made. Once granted entry by the Control Master, the individual module's blue A-Net LED will light solid to indicate that it is now receiving valid A-Net packets and is part of the Pro64 network.



The blue LED is used to indicate network status.

If valid A-Net packets are not received, the module will reset and wait until a valid A-Net stream is detected.

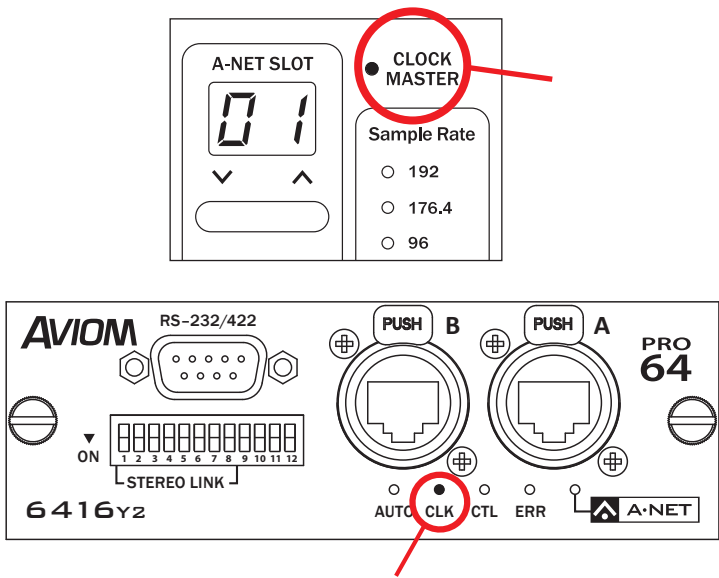
During enumeration, any conflicts will also be resolved. For example, consider a new Auto Mode installation using eight input modules set to the same A-Net Slot range with all channels activated during a bench configuration. When all these input modules are connected and then powered up, only one of them will be allowed to have all 16 channels activated. The remaining seven modules will have their audio channels deactivated. Conflicts with channel activation on 6416Y2 cards must be resolved manually since Slot activation is controlled via DIP switches.

Adding Pro64 Modules to a Network

When a new device is added to an existing Pro64 network, the new device makes a request to the Control Master for inclusion in the network. During this time, the new module's blue A-Net LED will flash. When the new module has been enumerated by the Control Master, its blue A-Net LED will then light solidly to indicate that the Control Master has granted the module access to the network. Adding a new module will interrupt network operation briefly.

Control Master and Clock Source

The Pro64 device designated as Control Master is also in control of the network master clock. The front-panel Clock Master LED lights to indicate that a module is designated as the network's master clock source. (The 6416dio Digital I/O Module is the only exception to this rule.)



The red Clock Master (CLK) LED lights when a Pro64 device is the Control Master.

When an analog I/O module is the Control Master, no other analog module can be used as a clock source in an all-analog network. When a 6416Y2 console interface card is part of a Pro64 network, the 6416Y2 can be used as a Clock Master for the network, but it must also be the network's Control Master to do so.

When using a 6416Y2 card as the Clock Master, the clock is derived from the

Yamaha host device and shared throughout the Pro64 network. That clock reference can be the Yamaha host's internal clock or an external clock to which the Yamaha host device is synced. Changes to the host device's sample rate will affect available A-Net Slots.

Multiple 6416Y2 cards can be used in a Yamaha host device, but only *one* can be set to be Control Master, which automatically makes this card the Clock Master.

Other Clock Sources

External clock sources for the Pro64 network can include:

- The internal clock from the Yamaha device
- Word Clock received via the external Word Clock inputs on a Yamaha device
- Word Clock connected to the dedicated BNC Word Clock jack on a Pro64 digital I/O device, such as the 6416dio Digital I/O Module
- The AES3 (AES/EBU) clock signal embedded in an AES3 digital signal connected to a Pro64 digital I/O module such as the 6416dio

Clock Errors

If a clock error occurs, the Clock Master LED will blink indicating that an error has occurred. Common causes for a clock error include:

- Attempting to change the sample rate on a device other than the Clock Master
- Attempting to change the clock source when the network is password protected
- Removing or changing external clock sources on a digital I/O module
- Incorrect configuration of an external clock source on a digital I/O module
- Attempting to use a sample rate higher than 96kHz with the 6416Y2 card

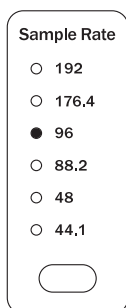
Network Sample Rate

When an analog device is the Control Master, the Control Master device is automatically designated as the network Clock Master. It will remain the Clock Master until a different analog module is made the Control Master or until a digital module such as the 6416Y2 card is added to the network and is assigned to be the Control Master and Clock Master.

The network's internal master clock is derived from the sample rate currently in use. The sample rate also affects the total number of available A-Net Slots available for use in the Pro64 network.

The Clock Master LED on the 6416Y2 card (labeled CLK) will light automatically when its Yamaha host is powered on if the 6416Y2 card is Control Master and Clock Master for the Pro64 network.

The Sample Rate section of a rack-mounted hardware I/O module's front-panel interface (e.g., 6416i Input Module) includes a group of LED indicators for displaying the current network sample rate. One LED will be lit at all times. The 6416Y2 card has no such LEDs. However, the current sample rate information *will* be sent to all Pro64 network devices when a 6416Y2 card is Control Master/Clock Master.



The sample rate display on Pro64 I/O modules will display the current network-wide sample rate when a 6416Y2 A-Net Interface Card is the Clock Master, receiving its clock from the Yamaha host device.

The current sample rate for the network will be displayed on all I/O modules in the network, and will update to reflect any changes made from the Yamaha host (such as changing the sample rate from 44.1kHz to 48kHz, or from 48kHz to 96kHz). Only one sample rate can be used at a time in a Pro64 network.

- ✓ **NOTE:** If multiple Yamaha devices with 6416Y2 cards installed are used in a Pro64 network, only one 6416Y2 card can be set as the Pro64 network Control Master. Each additional Yamaha device must be a clock slave in this situation.

Changing the Sample Rate

Changing the sample rate when a 6416Y2 A-Net Interface Card is the Clock Master is done from within the Yamaha user interface. Changing the sample rate will affect the number of available A-Net Slots when the sample rate changes from the 1x range (44.1/48kHz), to the 2x range (88.2/96kHz), or vice versa. Note that only sample rates up to 96kHz are supported by Yamaha digital devices.

Auto/Manual Mode Selection

The Control Master can be used to set the current network mode to Auto or Manual. As with the system-wide sample rate, the network mode is also a global setting. Only one Pro64 device can be Control Master in a network. Changes to the network mode must be made from the Control Master.

The 6416Y2 is configured using DIP switches, with DIP Switch Block 9 (SW9) on the circuit board used to set the network mode. This means that changes to the Pro64 network mode require the host Yamaha device to be powered down so that the 6416Y2 card can be safely removed.

Changing the Network Mode

To change the network mode from a 6416Y2 card that is the Pro64 network's Control Master, first power down the Yamaha host device and then remove the 6416Y2 card. Move switch 1 in Switch Block SW9 to the desired position, down for Auto Mode, or up for Manual Mode. Reinstall the card and power up the console. The Control Master will update the display on all modules in the network to reflect the mode change once the network is restarted.

Managed Mode

Managed Mode requires the use of a computer with the Pro64 network for tasks such as firmware updates, system monitoring, control, and editing. The Control Master is the only module that can allow the network to enter Managed Mode.

Entering Managed Mode from a 6416Y2 card requires that the 6416Y2 card be the network's Control Master. DIP Switch Block 9 (SW9) is used to set the network for Managed Mode operation. This means that changes to the Pro64 network mode require the host Yamaha device to be powered down so that the 6416Y2 card can be removed.

To change the network mode from a 6416Y2 card that is the network Control Master, move switch 10 in SW9 to the *up* position. Once the network enters Managed Mode, all rack-mount I/O modules will light their Managed LEDs. Note that the 6416Y2 does not have a Managed Mode LED.

To manage a Pro64 network with a computer, the PC needs to be connected to the Control Master using a DB9 null modem cable connected to the RS-232 port. The 6416Y2 card must be set for RS-232 operation and not for RS-422; this is done from DIP Switch Block 4 (SW4) on the circuit board. See page 32 for more information.

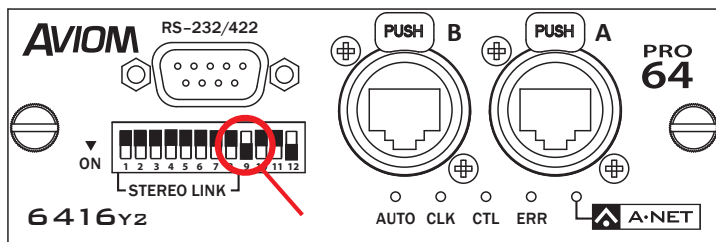
Exiting Managed Mode also requires that the host Yamaha device be powered down so that the 6416Y2 card can be removed to have DIP switch settings changed.

Password Protection

A Pro64 network can be password protected from the Control Master only. Once protected, the front-panel interface on all modules is locked, preventing changes to A-Net Slots, sample rate, clock source, channel activation, stereo links, and Virtual Data Cable assignments. Hardware switches, such as gain settings on input and output modules, and rear-panel DIP switches are in the analog domain and are not affected. Password protection remains in force even when a system is power cycled.

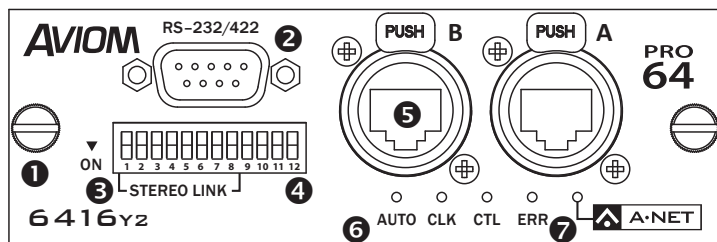
All Pro64 hardware I/O devices except console interface cards ship with a default password. The 6416Y2 card can be used to lock the network, but no password is available.

To lock the Pro64 network, move switch 9 in the front-panel DIP switch block to the *down* position. Changes to the network lock status will be instantly reflected on other network modules. No edits are possible until the network is unlocked. When the 6416Y2 card is Control Master, simply move switch 9 in the front-panel DIP switch block to the *up* position to unlock the network and allow changes to be made.



DIP Switch 9 on the front panel can be used to lock the Pro64 network when in the down position.

6416Y2 Card Components



1. Thumb Screws
2. RS-232/422 DB9 connector
3. DIP Switches 1-8 – Stereo Link
4. DIP Switches 9-12 – system control
5. Locking EtherCon RJ45 A-Net connections
6. Auto Mode, Clock Master (CLK), Control Master (CTL), and Error (ERR) LEDs
7. A-Net active LED

Front Panel Features

This section describes the features and functions of the front panel of the 6416Y2 A-Net card interface.

Thumb Screws

The two permanently attached thumb screws on the 6416Y2 card are used to secure the card to an MY expansion slot in the Yamaha device. Always make sure that both thumb screws are firmly attached when using or transporting the Yamaha device with a 6416Y2 installed.

RS-232/422 Port

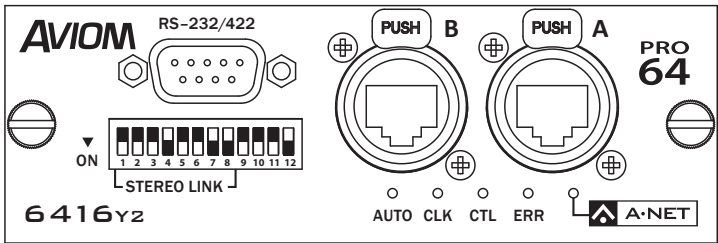
The nine-pin DB9 RS-232/422 port can be configured to send/receive control data from the Yamaha interface or from the Pro64 Virtual Data Cables. Selection of RS-232 or RS-422 and baud rate configuration is done via the DIP switches on the circuit board of the 6416Y2 card.

Each type of control data communication—RS-232 and RS-422—requires a unique cable. RS-232 requires a null modem cable; RS-422 requires a straight-

through cable. Cable pinouts for RS-232 and RS-422 are available elsewhere in this document.

DIP Switches

There is one 12-position DIP switch block on the front panel of the 6416Y2, referred to as SW7 in the diagrams that follow. Note the mounting direction of the DIP switches; to activate a switch on SW7, move it to the *down* position. The default setting for all switches in this block is *up*.



In this diagram, channels 7-8, 13-14, and 15-16 are stereo linked. This 6416Y2 is also the network Control Master. DIP switch handles are indicated in black.

Clock and Control DIP Switches

Within front panel DIP Switch Block SW7 is a group of four system-level DIP switches. These control the system lock via password, 6416m preamp remote control via m-control, firmware update status, and Control Master vs. Slave status respectively.

Switch	Function Off (up)	Function On (down)
1-8	Single channel control	Stereo Link (per channel pair: 1-2, 3-4, etc.)
9	System Unlocked	System Locked
10	m-control Off	m-control On
11	Local Code Update Off (This switch is scanned only at power up.)	Local Code Update Active
12	Slave Device	Control Master

Stereo Link DIP Switches

Eight Stereo Link DIP switches are provided allowing odd-even channels to be paired for use with Aviom Pro16 personal monitoring products such as the A-16II and A-16R Personal Mixers. (This application requires the ASI A-Net Systems Interface.) Each DIP switch controls a pair of channels. Stereo Link information will be passed to all Pro64 modules. If applicable, a Stereo Link LED will light on Pro64 output modules such as the analog 6416o Output Module and 6416dio Digital I/O Module when stereo information is present in the network.

System Lock

When the 6416Y2 card is the Pro64 network Control Master, DIP switch 9 controls the Password Lock feature, allowing all devices in the network to be locked from a single location. Unlike Pro64 hardware I/O devices, there is no way to set a password code on the 6416Y2 card. The Pro64 network is locked/unlocked immediately when the DIP switch is moved. No edits are possible when the network is locked.

m-control

Use DIP switch 10 on the front panel to activate the m-control™ for Yamaha Digital Consoles feature, allowing remote control of 6416m Mic Input Module preamp settings such as gain, phantom power, and low cut filter directly from the Yamaha user interface.

Local Code Update

The Local Code Update DIP switch is used in conjunction with the Pro64 firmware update application. This switch is scanned only when the host Yamaha device is powered up. Changing the position of this DIP switch requires a reboot of the host device for the switch position to be recognized.

Control Master/Slave

DIP switch 12 is used to set the 6416Y2 card as either the network Control Master (down) or as a slave device (up). Note that only one Pro64 device can be Control Master in a network. Although this DIP switch setting can be changed on the fly, note that the Pro64 network will need to reset if a new Control Master device is selected. Audio and control data are interrupted while the network resets.

A-Net Ports

Two Pro64 A-Net ports are provided on the 6416Y2 card, labeled A and B. Each port has a Neutrik® EtherCon® connector and can support standard RJ45 cables or those fitted with the heavy-duty EtherCon plug.

Multiple 6416Y2 cards can be used in compatible Yamaha devices by linking them together via the A-Net ports with a short Cat-5e jumper cable.

Front Panel LEDs

A set of five LEDs on the front panel of the 6416Y2 card is used to inform the user of various network conditions and/or error states as described below.

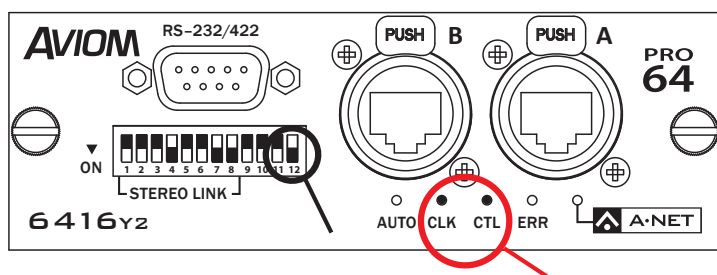
Auto LED

The Auto LED will be on and lit yellow to indicate that the Pro64 network is running in Auto Mode. In the off state, this LED indicates that the network is operating in Manual or Managed Mode.

Control Master (CTL) LED

The yellow Control Master (CTL) LED indicates that the 6416Y2 card is set to be the network's Control Master. A 6416Y2 card set to be the network's Control Master is automatically set to be the network Clock Master as well, deriving the network clock from the Yamaha host device. Only one Pro64 device can be set to be the Control Master, regardless of the number of 6416Y2 cards installed.

When off, this LED state indicates that the card is a slave device. For more info about the Control Master, see page 17.



Here, DIP switch 12 is in the down position, making this 6416Y2 card the Pro64 network Control Master. When DIP switch 12 is in the down position, both the Control Master (CTL) and Clock Master (CLK) LEDs will be lit. This 6416Y2 card is also the Clock Master when it is set to be the Control Master. (DIP switch handles are shown in black.)

Clock (CLK) LED

The Clock (CLK) LED will light yellow when the 6416Y2 card is set to be the Pro64 network's Control Master, which automatically sets the card to be the network Clock Master. When the 6416Y2 card functions as the network Clock Master, its clock is derived from the Yamaha host device.

Only one Clock Master is possible in a Pro64 network. The Clock LED will remain unlit when the 6416Y2 card is a slave device to another clock source (either the Pro64 network internal clock or from an external Word Clock reference connected to a Pro64 digital I/O module such as the 6416dio).

Error (ERR) LED

The Error LED will light red to indicate errors in enumeration, configuration, or clocking.

A-Net LED

Whenever a valid A-Net connection is detected, the blue A-Net LED will light solid. The A-Net LED will flash during the network enumeration process as Pro64 devices are added to the network, or during a firmware update. If no valid Pro64 A-Net signal is detected, the A-Net LED remains off.

Circuit Board DIP Switches

The 6416Y2 A-Net Interface Card is configured using DIP switches. Each block of switches is labeled on the circuit board with the abbreviation “SW” followed by a number. There is one DIP switch block on the front face of the card (SW7), and there are six DIP switch blocks on the card’s circuit board. These will be hidden once the card is installed.

The following table lists the functions of the various DIP switch blocks on the 6416Y2. Note the locations of the various switches on the diagram that follows the table. Also note that Switch Block SW7 is on the front panel of the card, facing the user.

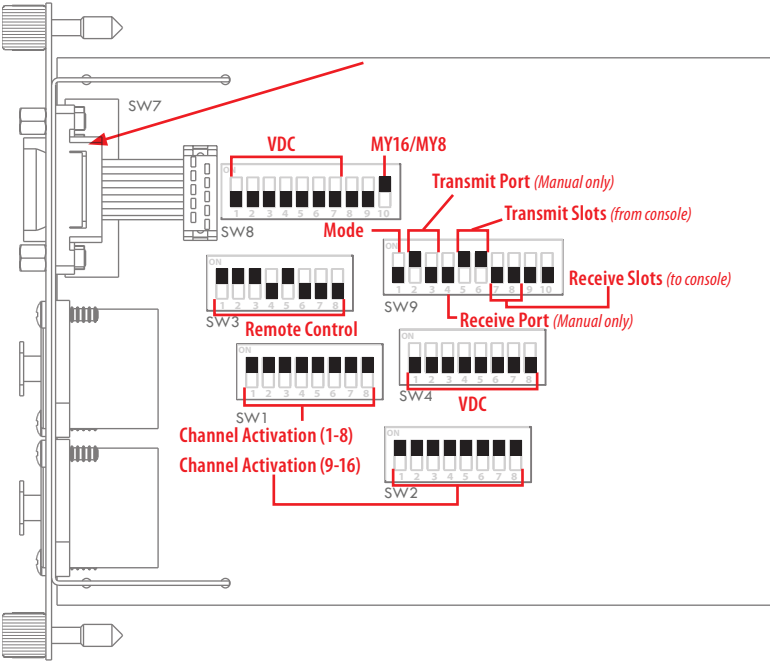
DIP Switch Block Functions

Switch Label	Location	Total Switches	Function(s)
SW1	Circuit board	8	Activation on/off for channels 1-8 from the Yamaha device being routed into the Pro64 network
SW2	Circuit board	8	Activation on/off for channels 9-16 from the Yamaha device being routed into the Pro64 network
SW3	Circuit board	8	m-control configuration
SW4	Circuit board	8	Configuration of RS-232/422 Virtual Data Cable (VDC) on rear panel of 6416Y2 card
SW7	Front panel	12	Stereo Link, Network Password Lock, m-control on/off, Code Update on/off, Control Master/Slave configuration
SW8	Circuit board	10	VDC Port configuration
SW9	Circuit board	10	Pro64 Network Mode, Transmit/Receive Port and Slot selection, Managed Mode on/off

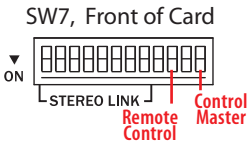
- ✓ **NOTE:** Always power off the Yamaha host device before removing a 6416Y2 card to make changes to any DIP switch settings.

DIP Switch Locations

This diagram shows the locations of the 6416Y2 DIP switches.



The 6416Y2 DIP switches; the arrow indicates SW7, on the front of the card, shown below. (DIP switch handles are indicated in black.)



DIP Switch Functions

The individual switch functions for circuit board DIP switch blocks SW1, SW2, SW3, SW4, SW8, and SW9 are detailed in this section.

DIP Switch Block 1 (SW1)

Use Switch Block 1 (SW1) to activate channels 1-8 on the 6416Y2 card and assign them to Slots within the Pro64 network. In the down position, channels 1-8 are off; move a DIP switch to the up position to activate a channel and assign it to a Slot in the Pro64 network.

The default position for the SW1 DIP switches is down (channel-to-Slot activation is off).

- ✓ **NOTE:** Signals from the Yamaha device cannot be routed into the Pro64 network unless these DIP switches are activated.

DIP Switch Block 2 (SW2)

Switch Block 2 (SW2) is used to assign channels 9-16 on the 6416Y2 card to Slots in the Pro64 network when operating in MY16 Mode (channels 9-16 are not available in MY8 Mode). In the down position, channels 9-16 are off; move a DIP switch to the up position to activate a channel, which assigns it to a Slot and makes it available throughout the network.

- ✓ **NOTE:** Routing an audio resource from within the Yamaha user interface to the 6416Y2 installed in an expansion slot requires that the SW1 and SW2 Slot activation DIP switch settings be set correctly in order to pass digital information from the Yamaha device to the Pro64 network.

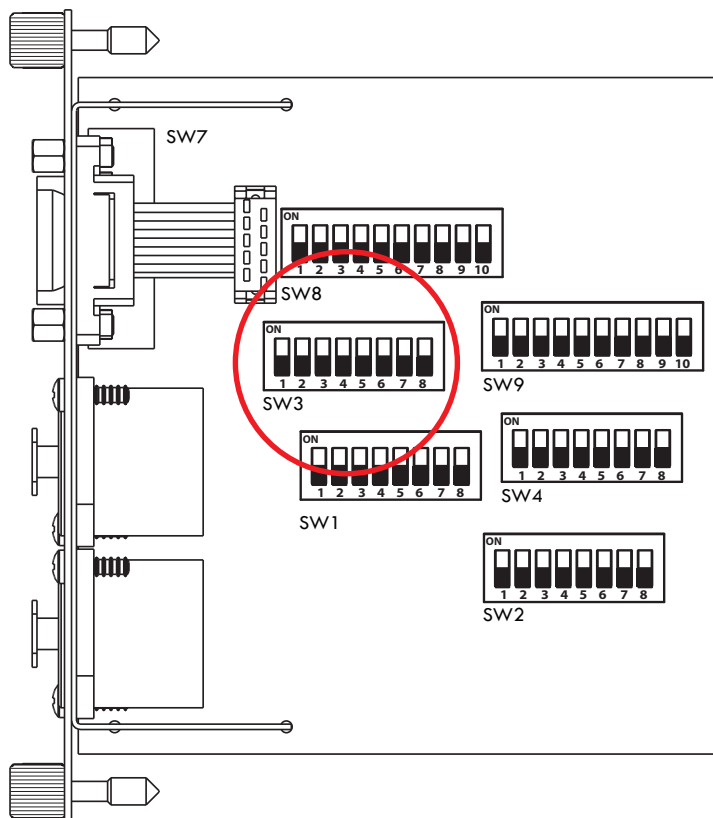
The exact Pro64 Slot range to which the channels from the 6416Y2 card are routed is determined by the settings of DIP switches 5 and 6 on block SW9.

The default position for the SW2 switches is down (channel-to-Slot activation is off). When operating in MY8 mode, leaving these switches in the down position will help avoid potential Slot availability conflicts with other Pro64 devices in the network.

A blank DIP switch template is provided at the end of this User Guide to allow you to record and save 6416Y2 card settings.

DIP Switch Block 3 (SW3)

The DIP switches in block SW3 are used to configure m-control, a feature that allows the user to control preamp settings on the 6416m Mic Input Modules in the Pro64 network directly from compatible Yamaha consoles.



SW3 configures the m-control feature, for use with 6416m mic preamps.

See page 42 for more info on setting up m-control.

The switches on SW3 have the following functions.

DIP Switch Block SW3 Functions		
DIP Switch	Parameter	Function
1	Channel/Slot Control 1-16	Activates m-control for 6416m channels 1-16 from the current Yamaha device
2	Channel/Slot Control 17-32	Activates m-control for 6416m channels 17-32 from the current Yamaha device
3	Channel/Slot Control 33-48	Activates m-control for 6416m channels 33-48 from the current Yamaha device
4	Channel/Slot Control 49-64	Activates m-control for 6416m channels 49-64 from the current Yamaha device
5	RS-422 Control Source Select (Backplane or DB9 connector)	Selects the source of the Yamaha RS-422 remote control information—directly from the console's backplane connector, or from the DB9 Remote connector (depends on the console)
6	<i>Unused/Reserved</i>	
7	6416m Mic Input Module Control Group assignment	Sets a Control Group (1-4) for the console and 6416Y2 card; allows only mic preamps in the same Control Group to be changed
8		

Note that any combination of switches 1-4 on block SW3 can be used to send control to a specific range of active Pro64 6416m mic preamp channels. This set of DIP switches will typically be set to less than or equal to the total number of channels that the console can support—16 channels on the LS9-16, 32 channels on the LS9-32, 48 channels on the M7CL, and 64 channels on the PM5D.

The table below shows parameters that can be changed on DIP switch block SW3. Remember that any combination of DIP switches 1-4 can be used to allow control to be sent to a specific range of active Pro64 mic preamp channels.

DIP Switch Block SW3 Settings			
DIP Switch	Parameter	Down	Up
1	Channel/Slot Control 1-16	Control off	Control on (1-16)
2	Channel/Slot Control 17-32	Control off	Control on (17-32)
3	Channel/Slot Control 33-48	Control off	Control on (33-48)
4	Channel/Slot Control 49-64	Control off	Control on (49-64)
5	RS-422 Control Source Select	Use backplane connector	Use DB9 Remote connector
6	<i>Unused/Reserved</i>		
7/8	Control Group	<i>See table below</i>	

Control Group	DIP Switch 7	DIP Switch 8
1	Down	Down
2	Up	Down
3	Down	Up
4	Up	Up

The Channel/Slot Control settings are separate from the audio I/O setup (including A-Net Transmit and Receive settings). This parameter sets up remote control communications for all 6416Y2 cards installed in the same console. Each 6416Y2 card needs its A-Net Transmit and A-Net Receive range properly configured in order to get the desired results for your application.

DIP Switch Block (SW4)

The DB9 RS-232/422 Virtual Data Cable (VDC) port on the 6416Y2 card's front panel is configured using SW4. Use the eight DIP switches in this block to choose baud rate settings for communicating with other RS-232/422 compatible devices.

The switches on SW4 have the following functions.

Switch	Function Off (down)	Function On (up)
1	One Stop Bit	Two Stop Bits
2	7 Data Bits	8 Data Bits
3	Parity Even	Parity Odd
4	No Parity	Parity
5	<div>Baud Rate Select</div> <div>See Baud Rate Table</div>	
6		
7		
8		

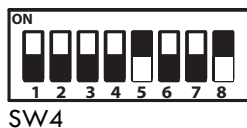
Baud Rate Table

Use the following table to set baud rates for DIP switches 5-8 in Switch Block SW4. The down position is **OFF** and the up position is **ON** for each DIP switch.

Baud Rate	DIP Switches in Block 4 (SW4)			
	5	6	7	8
1200	off	off	off	off
2400	on	off	off	off
4800	off	on	off	off
7200	on	on	off	off
9600	off	off	on	off
14400	on	off	on	off
19200	off	on	on	off
28800	on	on	on	off
38400	off	off	off	on
57600	on	off	off	on
31250 (MIDI)	off	on	off	on

✓ **NOTE:** The default baud rate used by Yamaha mic preamps is 38400.

The individual DIP switches in each Switch Block are numbered 1-8, from left to right.



This example shows Switch Block SW4 set for a baud rate of 57600 (DIP switch handles shown in black).

The pinout of the RS-232/422 jack on the 6416Y2 card appears later in this document. See page 70 for more information.

DIP Switch Block 8 (SW8)

SW8 is used to select either RS-232 or RS-422 operation for the data port on the 6416Y2 card and to assign these ports to the 14 available VDC Slots in the Pro64 network.

Block SW8 has ten individual DIP switches, whose functions are outlined in the table below.

DIP Switch Block 8 (SW8) Functions		
Switch	Function Off (down)	Function On (up)
1	DB9 port on front of card communicates using RS-232	DB9 port on front of card communicates using RS-422
2	Backplane RS-232/422 VDC Slot Assignment 0 *	Backplane RS-232/422 VDC Slot Assignment 0
3	Backplane RS-232/422 VDC Slot Assignment 1	Backplane RS-232/422 VDC Slot Assignment 1
4	Backplane RS-232/422 VDC Slot Assignment 2	Backplane RS-232/422 VDC Slot Assignment 2
5	Front panel RS-232/422 VDC Slot Assignment 0 *	Front panel RS-232/422 VDC Slot Assignment 0
6	Front panel RS-232/422 VDC Slot Assignment 1	Front panel RS-232/422 VDC Slot Assignment 1
7	Front panel RS-232/422 VDC Slot Assignment 2	Front panel RS-232/422 VDC Slot Assignment 2
8	<i>Reserved</i>	<i>Reserved</i>
9	<i>Reserved</i>	<i>Reserved</i>
10	MY8 Mode	MY16 Mode

* See tables below for specific DIP switch settings for VDC assignments.

The default setting for DIP switch 1 is RS-232.

VDC connections to the Yamaha backplane (switches 2, 3, and 4), are not supported on all Yamaha digital products—currently only the LS9 series products can make use of this option; consult Yamaha for compatibility information.

VDC Slot Assignments - Backplane VDC Port

Combinations of switches 2, 3, and 4 within SW8 are used to assign Virtual Data Cable Slots for the backplane VDC port. The following table lists the possible settings for the 14 VDC Slots available in a Pro64 network.

Note that RS-232/422 communication always requires a pair of Virtual Data Cable Slots and that this pair must always be an odd-even combination of VDCs. The down position is **OFF** and the up position is **ON** for each DIP switch.

VDC Slot Assignments for the Backplane VDC Port - Switch Block SW8			
VDC Slot Pair	DIP Switch 2	DIP Switch 3	DIP Switch 4
OFF	off	off	off
1 & 2	on	off	off
3 & 4	off	on	off
5 & 6	on	on	off
7 & 8	off	off	on
9 & 10	on	off	on
11 & 12	off	on	on
13 & 14	on	on	on

VDC Slot Assignments - Front Panel VDC Port

Switches 5, 6, and 7 are used to assign Virtual Data Cable Slots for the front panel RS-232/422 VDC port. The following table lists the possible settings for the 14 VDC Slot assignments available in a Pro64 network.

RS-232/422 communication always requires a pair of Virtual Data Cable Slots; this pair must always be an odd-even combination of VDCs. The default setting for DIP switch 1 in block SW8 is RS-232.

VDC Slot Assignments for the Front Panel VDC Port - Switch Block SW8			
VDC Slot Pair	DIP Switch 5	DIP Switch 6	DIP Switch 7
OFF	off	off	off
1 & 2	on	off	off
3 & 4	off	on	off
5 & 6	on	on	off
7 & 8	off	off	on
9 & 10	on	off	on
11 & 12	off	on	on
13 & 14	on	on	on

The individual DIP switches on block SW8 are numbered 1-10, from left to right.



SW8

This example shows block SW8 with an RS-422 port assigned to VDC Slot 5-6. Switch handles are shown in black.

MY8 and MY16 Mode Operation

Yamaha digital products can operate in either 8-channel or 16-channel modes (called MY8 and MY16 respectively). MY8 Mode allows eight channels of I/O per expansion card at sample rates up to 96kHz. MY16 Mode operation allows up to 16 channels per expansion card at the 44.1/48kHz sample rate. The 6416Y2 can be set to accommodate these modes by setting DIP switch 10.

DIP Switch Block 9 (SW9)

Switch Block SW9 controls network-level functions such as Auto/Manual Mode selection and A-Net transmit/receive settings.

DIP Switch Block 9 (SW9) Functions		
Switch	Function Off (down)	Function On (up)
1	Auto Mode	Manual Mode
2	A-Net Transmit Port (A, B, or A+B) Select 0 *	A-Net Transmit Port (A, B, or A+B) Select 0
3	A-Net Transmit Port (A, B, or A+B) Select 1	A-Net Transmit Port (A, B, or A+B) Select 1
4	A-Net Receive Port (A or B) Select *	A-Net Receive Port (A or B) Select
5	Transmit Audio Base Slot Select 0 *	Transmit Audio Base Slot Select 0
6	Transmit Audio Base Slot Select 1	Transmit Audio Base Slot Select 1
7	Receive Audio Base Slot Select 0 *	Receive Audio Base Slot Select 0
8	Receive Audio Base Slot Select 1	Receive Audio Base Slot Select 1
9	<i>Reserved</i>	<i>Reserved</i>
10	Not Managed	Managed Mode
* The tables that follow show DIP switch settings for transmit/receive.		

Network Mode (Auto/Manual)

The Pro64 network can be set to operate in either Auto Mode or Manual Mode using switch 1 in DIP Switch Block SW9. The default setting is Auto Mode.

A-Net Transmit Settings (Manual Mode)

The 6416Y2 A-Net Interface Card can transmit its activated channels to A-Net Port A, B, or both A and B when the network is running in Manual Mode. (This setting does not apply when the network is operating in Auto Mode.) Use switches 2 and 3 to direct A-Net data to a specific port.

A-Net Transmit Settings		
Port A	DIP Switch 2	DIP Switch 3
	off	off
Port B	on	off
Ports A and B	off	on
<i>Not supported</i>	on	on

A-Net Receive Settings (Manual Mode)

The 6416Y2 can receive A-Net data from the Pro64 network from Port A or Port B when the network is running in Manual Mode. (This setting does not apply when the network is operating in Auto Mode; both ports supply identical data.) Use DIP switch 4 to direct A-Net data from a specific 6416Y2 port to the Yamaha device.

A-Net Receive Settings	
Port A	DIP Switch 4
	on
Port B	off

A-Net Transmit Base Slot Settings

The 6416Y2 card can transmit its activated channels to an 8-channel (MY8 Mode) or 16-channel (MY16 Mode) block of slots within the Pro64 network. Switches 5 and 6 are used to determine where in the Pro64 network activated channels from the Yamaha device should be sent. Base Slot refers to the first channel number in a group of 8 or 16 channels.

A-Net Transmit Base Slot Settings			
MY16 Mode	DIP Switch 5	DIP Switch 6	MY8 Mode
Slots 1-16	off	off	Slots 1-8
Slots 17-32	on	off	Slots 9-16
Slots 33-48	off	on	Slots 17-24
Slots 49-64	on	on	Slots 25-32

Note that when running the Yamaha device or Pro64 network at sample rates higher than 48kHz, only Slots 1-32 are available.

A-Net Receive Base Slot Settings

Data from the Pro64 network can be assigned in blocks of 16 channels to the Yamaha host device for mixing, processing, etc. Switches 7 and 8 are used to determine from where in the Pro64 network these channels should be drawn. At the 44.1/48kHz sample rate, 64 Slots/channels are available.

A-Net Receive Base Slot Settings			
MY16 Mode	DIP Switch 7	DIP Switch 8	MY8 Mode
Slots 1-16	off	off	Slots 1-8
Slots 17-32	on	off	Slots 9-16
Slots 33-48	off	on	Slots 17-24
Slots 49-64	on	on	Slots 25-32

By default, A-Net Slots 1-16 are assigned to the host Yamaha device when operating the card in MY16 Mode. One group of 16 channels is always assigned to be available to the Yamaha host device. In MY8 Mode, 8 channels are available.

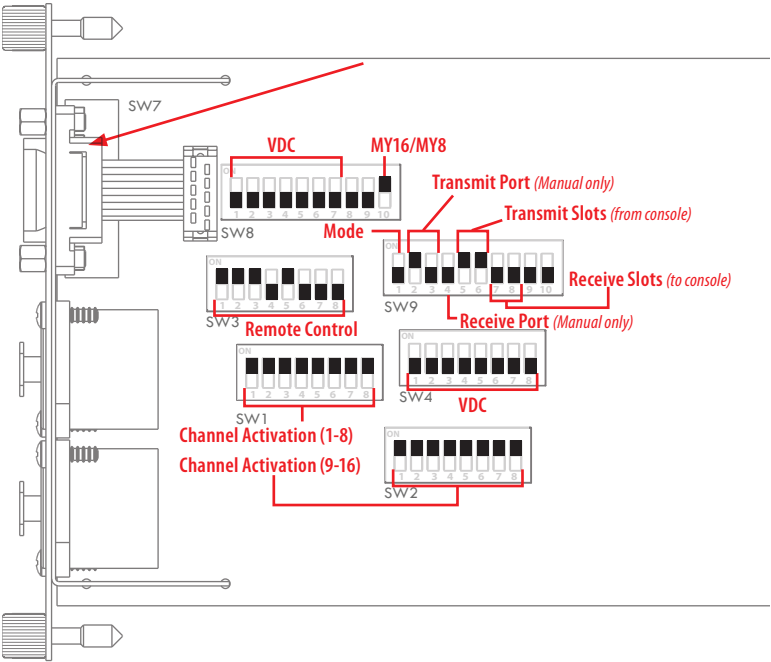
Managed Mode

Switch 10 in Switch Block SW9 sets the Pro64 network to operate in Managed Mode. This switch only functions when the 6416Y2 card is set to be the network's Control Master. Remember that even in a network where multiple Yamaha devices with 6416Y2 cards installed exist, only one 6416Y2 card can be set as the Control Master.

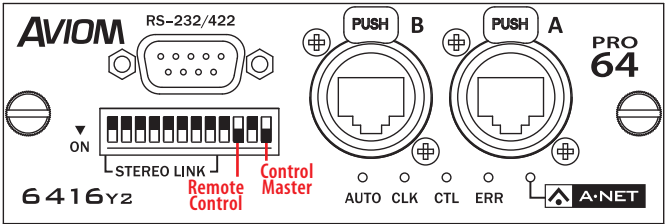
Managed Mode is used when updating firmware or whenever a computer is in control of a Pro64 network.

Configuring the 6416Y2 Card

The diagrams below details the functions of the 6416Y2 card's DIP switch blocks on the front panel and circuit board that will be used in the configurations that follow.



6416Y2 card showing the functions of the various DIP switches; the arrow indicates SW7, on the front of the card, shown below. (DIP switch handles are indicated in black.)

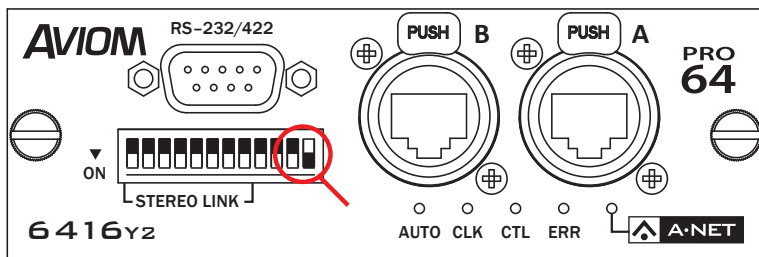


Choose a Control Master

The first step in setting up a Pro64 network is to decide which Pro64 device will be the Control Master. A Pro64 network always has one Control Master and one Clock Master. The Control Master is in charge of network-wide settings, channel/Slot management, Virtual Data Cable allocation, error messaging, etc. The Clock Master controls the network sample rate and can allow the use of external word clock sources if 6416dio Digital I/O Modules are part of the network. Any I/O device can be the Control Master, but only one Pro64 device may be in control of the network at a time.

6416Y2 as Control Master

On the front panel of the 6416Y2 card, DIP switch #12 is used to set the card as the network's Control Master—move it to the down position to make the 6416Y2 card the network's Control Master. When the 6416Y2 card is the Control Master, it is also automatically the network Clock Master, deriving the clock from the Yamaha host device.



This card is set to be the Control Master; DIP switch #12 is in the down position. (The DIP switch handles are shown in black.)

Pro64 I/O Modules as Control Master

To use another type of Pro64 module as the Control Master, such as a 6416m Mic Input Module, set the appropriate DIP switch on its rear panel to make it the Control Master. Make sure to set the 6416Y2 card for non-control operation (DIP switch #12 up) if it was previously used as the Control Master.

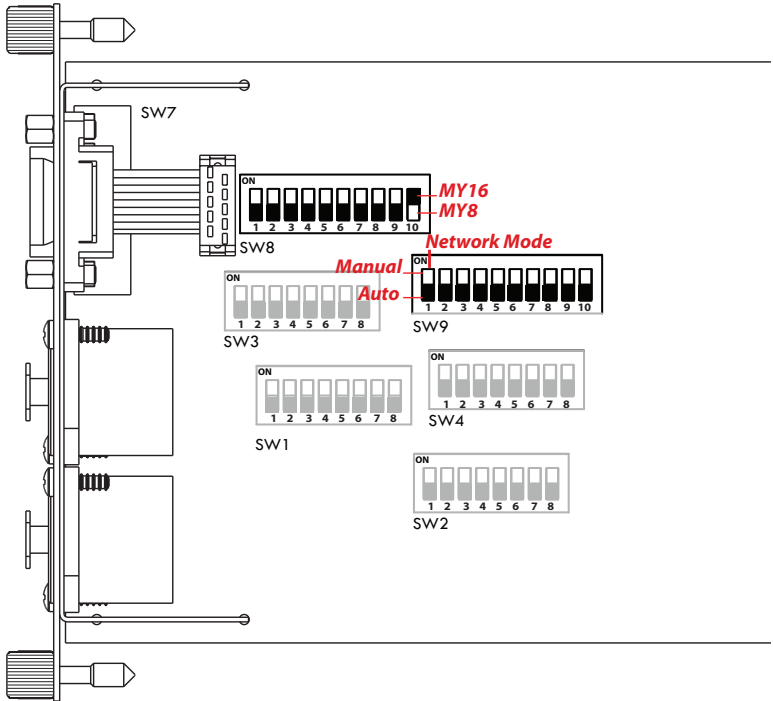
When an external Pro64 I/O module is used as the Control Master, all Yamaha digital consoles and DME in the system *must* be set to slave to the incoming clock from the Pro64 network. This is done on the DIO or Word Clock page depending on the console being used.

Failing to set the Yamaha device(s) to slave to the incoming Pro64 network clock will cause clicks, pops, and/or audio dropouts.

Set The Network Mode

Every Pro64 network has three operational modes. Auto Mode allows 64 active total channels at 48kHz, while Manual Mode provides 64x64 channels. Managed Mode requires a computer for control, and is used for firmware updates, etc.

The network mode is set on switch block SW9, and is only required to be set when a 6416Y2 card is used as a Control Master. DIP switch #1 in block SW9 selects Auto Mode in the down position or Manual Mode in the up position.



The first DIP switch in block SW9 sets the network to Auto Mode when in the down position.

Auto Mode provides 64 total channels/Slots at 44.1 or 48kHz, and 32 total channels/Slots at 88.2 or 96kHz. Cables can be connected to any available A-Net port.

Manual Mode provides 64x64 total channels/Slots at 44.1 or 48kHz, and 32x32 total channels/Slots at 88.2 or 96kHz. The user must connect cables to specific A-Net ports and route data to/from them as required by the application. Manual Mode is ideal for high channel count systems that have

clearly defined directional needs such as a 64 x 16 digital snake.

Although the Pro64 network can operate at sample rates higher than 96kHz, Yamaha devices cannot. The Pro64 176.4 and 192kHz sample rates are not available when using a 6416Y2 card in a Pro64 network.

MY8 and MY16 Modes

Switch block SW8 contains the setting for Yamaha's MY8 and MY16 Modes. MY16 Mode provides 16-channel operation at 44.1/48kHz sample rates, while the MY8 Mode provides 8-channel operation when using higher sample rates (88.2/96kHz) or when installing the 6416Y2 card in MY8-only devices such as the PM1D digital console at 48kHz.

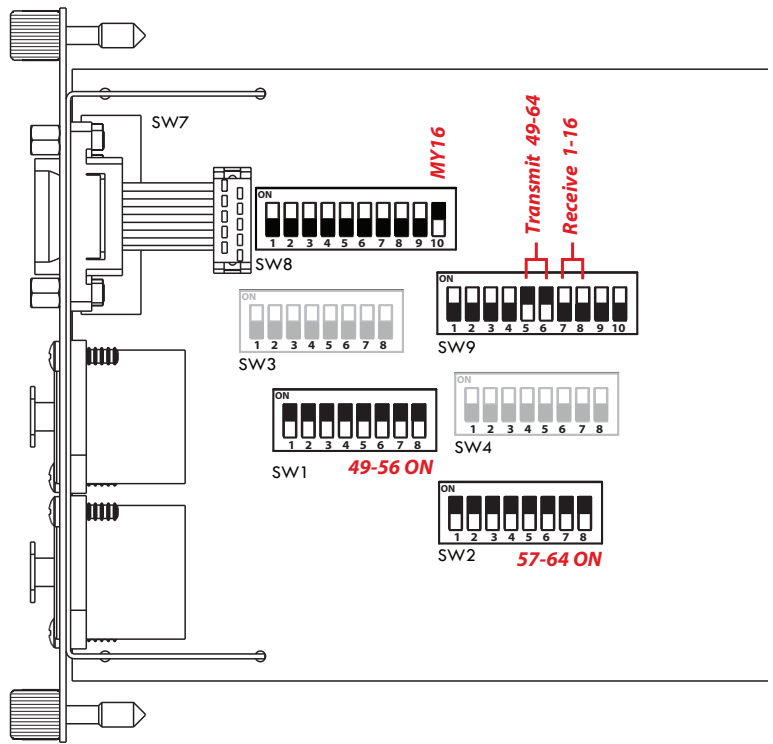
Set DIP switch #10 in block SW8 to the up position (as seen in the diagram above) for 16-channel operation at 44.1/48kHz.

Choose I/O Settings

Use switch block SW9 to set the range of Slots (in blocks of 16 channels) that each 6416Y2 card will use when transmitting/receiving audio.

DIP switches #7 and #8 are used for the *receive* Slot range, in groups of 16 channels (1-16, 17-32, 33-48, or 49-64). These are the channels from the Pro64 network being brought into the Yamaha device for mixing, processing, etc.

DIP switches #5 and #6 are used to select the network *transmit* Slot range (available settings are 1-16, 17-32, 33-48, or 49-64). Use these for audio being sent from the Yamaha device into the Pro64 network. Each Slot can be activated individually using SW1 and SW2 (see below).



Block SW9 is used to choose A-Net Slot transmit (Tx) and receive (Rx) settings. The 6416Y2 card shown here receives Slots 1-16 and transmits Slots 49-64 into the network.

Remember that the 6416Y2 card functions as both an input and an output module. Set different Pro64 network transmit/receive (Tx/Rx) Slot ranges to avoid channel/Slot allocation conflicts. This is especially important in multi-card systems.

Activate Channels/Slots

Once the Transmit base Slot range has been selected, use DIP switch blocks SW1 and SW2 to activate up to 16 individual Slots in that range, which sends audio from the Yamaha console (or DME) into the Pro64 network. No audio will flow from the Yamaha device into the Pro64 network unless the Slots are activated with these switches.

Move a DIP switch to the up (on) position to activate it, sending audio into the Pro64 network. Remember that in Auto Mode there can be only one channel assigned to each network Slot.

Individual channel/Slot activation allows the most flexibility; activate only the channels/Slots you need on each 6416Y2 card, leaving network Slot bandwidth available for other Pro64 devices in your network. A Pro64 network is capable of having a virtually unlimited number of devices in it. While the number of devices is unlimited, the bandwidth of the network itself is not.

Digital splits and copies of data within the Pro64 network are not subject to the 64 Slot maximum (at 44.1/48kHz); an unlimited number of copies of the same data can be used in both analog and digital formats as needed.

In most cases, you'll want the 6416Y2 card to run in Yamaha's MY16 Mode, which provides 16 channels in and out of the MY expansion slot at 48kHz. (This is set on switch block SW8 using DIP switch #10.)

Sample Systems

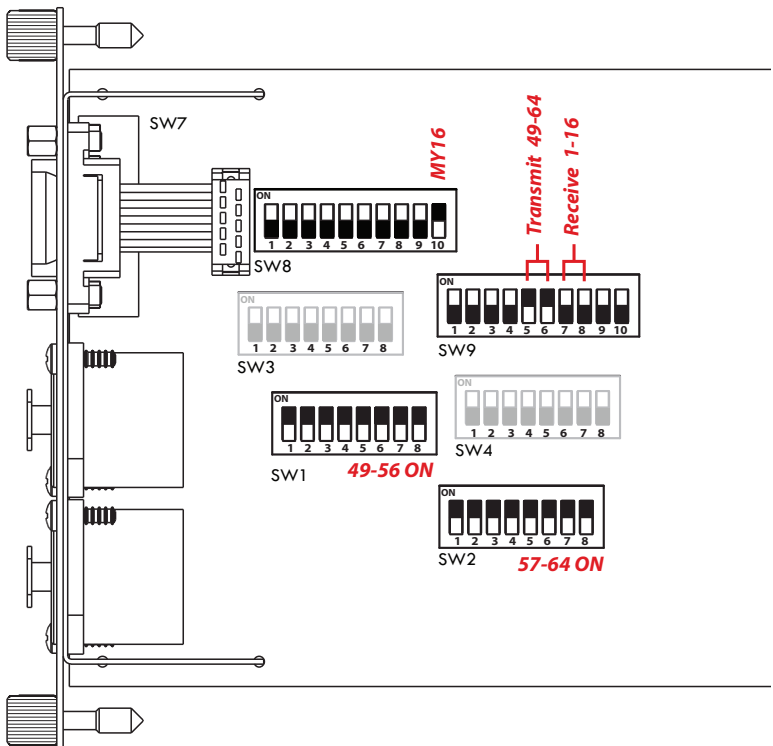
The following examples show 6416Y2 card settings that can be used as starting points for creating a system.

48 x 16 Digital Snake

The examples below show a three-card digital snake in Auto Mode set to receive Slots 1-48 from the network and transmit Slots 49-64 from the console into the Pro64 network.

Card #1 will be used to route return signals from the console back into the Pro64 network for amp/speakers or monitors via Slots 49-64. Only this card will have Slots activated, as seen in blocks SW1 and SW2.

Card 1 of 3

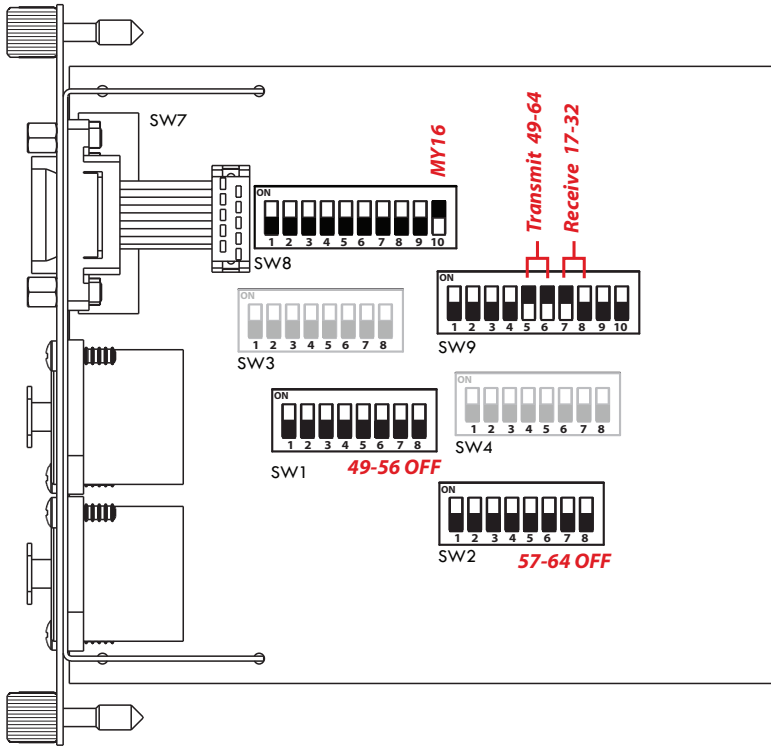


The first 6416Y2 card receives Slots 1-16 transmits Slot 49-64.

If you need less than 16 channels from the Yamaha device to be transmitted into the Pro64 network Slots, simply change the appropriate DIP switches in blocks SW1 and/or SW2. For example, to transmit only 8 total channels from the Yamaha console to the Pro64 network, move all DIP switches in block SW2 to the down position. Those Slots are then available to be used by other Pro64 input devices within the network.

Card 2 of 3

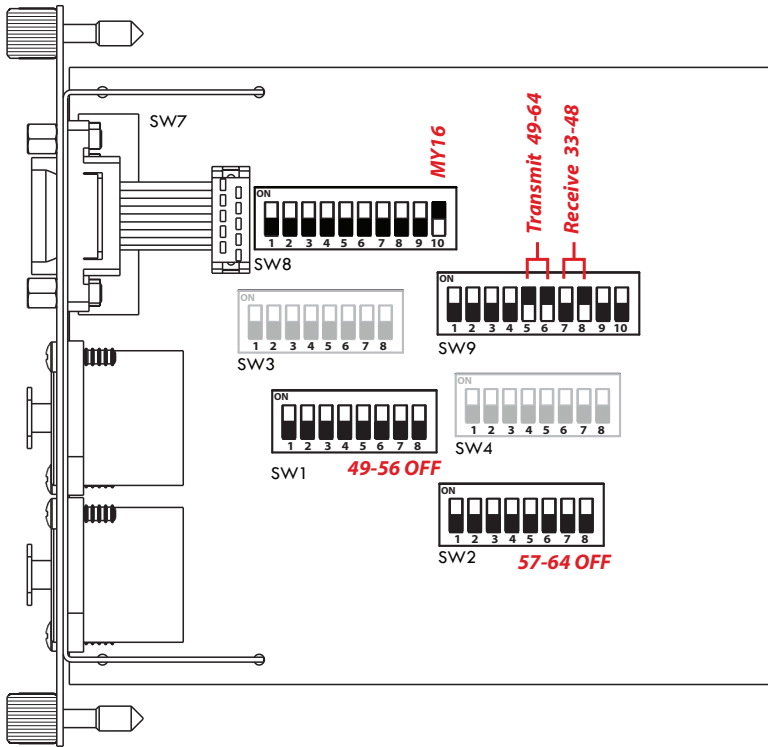
The second card in the 48 x 16 digital snake receives Slots 17-32 from the network. It has the same Transmit Slot settings as card #1, but note that all 16 activation switches in blocks SW1 and SW2 are in the off (down) position.



The second 6416Y2 card in the 48 x 16 digital snake receives Slots 17-32 and transmits nothing into the network.

Since the Transmit Slot range in SW9 is set to Slots 49-64 but has no active channels (as seen in SW1 and SW2) this parameter could be set to any other range with no impact on the digital snake's operation.

Card 3 of 3



The third 6416Y2 card in the 48 x 16 digital snake receives Slots 33-48 from the network. As with card #2, none of its Slots are transmitted back into the network even though the range is set to Slots 49-64.

As with card #2 of this digital snake, since the Transmit Slot range in SW9 is set to Slot range 49-64 but has no active channels (as seen in SW1 and SW2) this parameter could be set to any other range with no impact on the digital snake's operation.

Install the Cards

Install 6416Y2 card #1 into Yamaha MY expansion slot #1, 6416Y2 card #2 into MY expansion slot #2, etc., to simplify patching and routing from within the Yamaha user interface. Connect the 6416Y2 cards together with Cat-5e jumper cables.

If you are using the ASI A-Net Systems Interface to connect a monitoring system, connect the monitoring devices to the outputs marked 49-64 on the

rear panel of the ASI.

To create digital splits of the source signals in the network, simply connect Pro64 output devices such as the 6416o Output Module for analog outputs, the 6416dio for AES3 digital outputs, or even additional Yamaha digital consoles with 6416Y2 cards installed.

32 x 16 Digital Snake

To create a 32 x 16 digital snake you can use the diagrams given previously for the 48 x 16 snake. Delete 6416Y2 card #3 from the setup, leaving the Transmit and Receive Slot range settings on cards 1 and 2 the same.

Remote Control

If 6416m Mic Input Modules are installed as part of the digital snake you have the option of remote controlling the 6416m preamps from the network using the RCI Remote Control Interface and MCS Mic Control Surface or from the Yamaha console using m-control.

m-control



With m-control™ for Yamaha digital consoles, the 6416m Mic Input Module can be remote controlled directly from a Yamaha console's user interface when a 6416Y2 A-Net Interface Card is installed. Using m-control, an engineer has direct access to the 6416m preamp's gain control, +48V phantom power, and high pass (low cut) filter. Up to 64 channels of 6416m mic preamps can be controlled from a Yamaha console. Systems may utilize multiple simultaneous control points: multiple consoles, multiple RCI/MCS combinations, or any combination of the two.

Remote mic preamp control is not supported by every Yamaha console, and the actual number of remote controllable channels varies by console model. All existing 6416Y2 cards as well as 6416m and RCI modules in the field can be updated to take advantage of the remote control features.

Since using the Pro64 m-control feature requires the use of the RS-422 resources of the Yamaha console, simultaneously controlling Pro64 6416m mic preamps with m-control and Yamaha AD8HR preamps via the Virtual Data Cables™ (VDC) is not supported.

Yamaha Hardware Requirements

The following Yamaha devices can be used to send remote control commands to 6416m preamps via m-control:

- | | |
|-----------------------|----------|
| • LS9-16 | • DM1000 |
| • LS9-32 | • DM2000 |
| • M7CL-32 and M7CL-48 | • DME24N |
| • PM5D / PM5D-RH | • DME64N |

Console based remote control of the 6416m is not compatible with the PM1D, 01V96, and 02R96 consoles and the DSP5D expander for the PM5D because these devices do not have built-in RS-422 support. 6416Y2 A-Net cards may still be used with these devices for audio I/O.

Firmware Requirements

The m-control features require firmware version 2.41 or higher in the 6416Y2 A-Net card and firmware version 2.00 or higher in both the 6416m Mic Input Module and any RCI Remote Control Interfaces in the system. (The RCI is not required to use the console-based remote control feature, but it does need the firmware update if an RCI is installed in the same Pro64 network where m-control will be used.)

Before attempting to use the m-control remote control features, use the Pro64 Update Tool software to determine a Pro64 product's firmware version and to update it to the latest version. The current version of the Pro64 Update Tool application and all associated Pro64 firmware update files are available on the Aviom website free of charge.

DB9 Cables

Using m-control requires at least one 6416Y2 and one 6416m. A DB9 serial cable connected between the Yamaha device and the Aviom 6416Y2 card is required to make use of this feature on most consoles. Do not use a null modem type cable; null modem cables are typically used with RS-232 communications while serial cables are used with RS-422. Place DIP switch #1 in block SW8 in the up position when using a serial cable. (The down position should be used with a null modem cable only when connected to a PC for firmware updates, etc.)

The LS9 does not require an external DB9 remote control connection as its control data is passed from the console to the 6416Y2 card internally through the backplane connector that is part of the console's circuit board at the rear of the MY expansion card slot.

Remote Control Emulation

Aviom and Yamaha use different remote control architectures, and in order to provide the convenience of console-based control, Aviom emulates Yamaha's remote control scheme and presents remote controllable mic pre channels as "virtual devices" to the Yamaha console. Yamaha host devices associate external remote controllable mic preamps, referred to as Head Amp (HA) Devices, with their mini-YGDAI (MY) expansion card slots.

The most common remote controllable mic preamp connected to these consoles is the Yamaha AD8HR, an 8-channel device, so remote controllable Aviom channels appear to the console as AD8HR devices, and all text and graphics in the Yamaha user interface will refer to external AD8HRs. While each block of eight channels appears to the console as one virtual device, there is no requirement that the channels originate on the same 6416m Mic Input Module.

Similarly, there are differences in the functions for which Aviom and Yamaha provide remote control. In addition, the language used to describe these settings is different. For instance, while Aviom mic preamps can be muted remotely, Yamaha provides mute control only in the console (i.e., outside the A-Net network). Users who wish to have remote control of the 6416m channel mute at the preamp must use an MCS Mic Control Surface for remote control. When using m-control console-based remote control, the RCI and MCS can

still be used with the Pro64 network as an alternative means of providing control and network monitoring.

Likewise, Yamaha displays mic gain settings using a convention that is different from what Aviom and some other manufacturers use (for example, a range from +10dB (minimum) to -62dB (maximum)). The exact values vary by product. These are really just two different ways of displaying the same type of information. Yamaha's method shows the level of the incoming signal; for example, when the console HA gain setting is "-32," the console is trying to tell you "the level of your incoming signal is -32dB." On a 6416m, if the corresponding gain readout is "25," the 6416m display means "you are adding 25dB of gain to the incoming signal." Control settings sent from a Yamaha device will be interpreted by the 6416m automatically and displayed accordingly. There is no need for the user to make any translations between the two approaches to displaying the data.

Supported 6416m Features

When using Pro64's m-control feature, note that only parameters available natively on the Yamaha control surface itself and supported by the Yamaha interface can be controlled on the 6416m Mic Input Module remotely. These include channel preamp gain, low cut filter (referred to as a high pass filter in the Yamaha interface), and +48V phantom power on the 6416m. The 6416m has a fixed 85Hz low cut filter, while Yamaha consoles offer a variable range High Pass Filter (abbreviated as HPF) in their user interface. When using Yamaha remote control with Aviom 6416m preamps, you can turn this filter on and off, but the cutoff frequency remains fixed at 85Hz. Editing the HPF filter cutoff frequency from the Yamaha user interface will have no effect at the 6416m; the cutoff frequency remains fixed at 85Hz.

The 6416m pad setting is controlled indirectly through the head amp gain setting on the console. There is no direct command for turning the 6416m pad on or off from the Yamaha control surface.

Physical Connections

Remote control commands between the Yamaha host console and Pro64 remote mic preamps are sent using RS-422 communication. Many Yamaha devices have DB9 RS-422 jacks on their rear panel, while some others send remote control communication directly to external devices via the console's multipin backplane connector where the MY format expansion cards connect to the console's circuit board.

For Yamaha devices with a DB9 jack for remote HA control, a DB9 serial cable must be used to connect the console to the 6416Y2 card set up for m-control. No additional connections are required anywhere in the network,

as all remote control commands are managed by the Pro64 devices and transmitted via the network cabling.

In Pro64 systems where more than one 6416Y2 A-Net Interface Card is installed in a Yamaha console, only one of the 6416Y2 cards should be set to provide m-control communication and messaging between the Yamaha host and the Pro64 network. This one card will manage remote control communication for all 6416Y2 cards in the host console.

Channel Count and Control

As with audio I/O, the exact number of Aviom mic pre channels that can be controlled from a console is determined by the Yamaha device's expansion capability, the number of 6416Y2 cards that the host's power supply subsystem can support, the current MY mode being used (MY8 or MY16) and the current sample rate being used. Each MY expansion slot on a Yamaha console provides up to 16 channels of I/O and remote control functionality.

The LS9-32 console, for example, which has two MY slots available, can have two 6416Y2 cards installed in it and will have a maximum of 32 channels of external mic preamps available to be remote controlled in its user interface, displayed in four groups of eight channels. The LS9 uses MY16 mode and operates at 48kHz.

Use the following table to determine the number of Pro64 cards that a particular console can support.

Model	MY Slots	6416Y2 Cards	HA Remote Control	Cable Required	Card Mode	Sample Rates
DM1000	2	2	DB9 connector	DB9	MY16	44.1 kHz, 48 kHz
					MY8	88.2 kHz, 96 kHz
DM2000	6	5	DB9 connector	DB9	MY16	44.1 kHz, 48 kHz
					MY8	88.2 kHz, 96 kHz
DME24N	1	1	DB9 connector	DB9	MY16	44.1 kHz, 48 kHz
					MY8	88.2 kHz, 96 kHz
DME64N	4	4	DB9 connector	DB9	MY16	44.1 kHz, 48 kHz
					MY8	88.2 kHz, 96 kHz
PM5D PM5D-RH	4	4	DB9 connector	DB9	MY16	44.1 kHz, 48 kHz
					MY8	88.2 kHz, 96 kHz
M7CL	3	3	DB9 connector	DB9	MY16	44.1 kHz, 48 kHz
LS9-16	1	1	Backplane	none	MY16	44.1 kHz, 48 kHz
LS9-32	2	2	Backplane	none	MY16	44.1 kHz, 48 kHz

No Yamaha devices support Pro64's 176.4 and 192kHz sample rates.

DIP Switches

DIP switches in block SW3 allow the user to choose a specific Pro64 channel/ Slot range to control (in groups of 16 channels) as well as the total number of Pro64 channels available for remote control (subject to the limits of the host console's expansion capability as mentioned previously.) This allows multiple consoles to be used in the same Pro64 network, each with unique m-control settings.

The total number of channels that a 6416Y2 A-Net card can send to or receive from a Yamaha host device is also affected by the sample rate being used. In Yamaha's MY16 mode (used for 44.1/48kHz sample rates), each 6416Y2

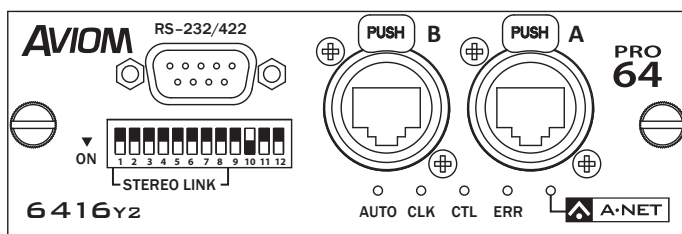
card (and its MY expansion card slot) will be associated with two virtual HA devices—16 channels total. In MY8 mode (88.2/96kHz), each 6416Y2 card installed is associated with a single virtual HA device (8 channels). Not all sample rates are available on every Yamaha console. Refer to the table above.

Only active Pro64 preamp channels can be controlled remotely; any remote control commands sent from a Yamaha console to inactive 6416m channels will be ignored. As with the RCI/MCS, the 6416Y2 must be set to the same Control Group as all 6416m Mic Input Modules to be controlled. The Control Group is assigned using the internal DIP switches on the 6416Y2 card, and a 6416Y2 card must always be part of a Control Group when using m-control; it cannot be set to the “off” Control Group as the 6416m and RCI can.

m-control Remote Control Settings on the 6416Y2

On the front panel of the 6416Y2 card, set DIP switch #10 to the down position to enable m-control.

Note that even though multiple 6416Y2 cards can be installed in a Yamaha digital device, only one 6416Y2 card needs to be set to provide remote control messages from the Yamaha device to the Pro64 network.



DIP switch #10 in the down position enables console remote control. (DIP switch handles are shown in black.)

Once remote control is enabled, DIP switch block SW3 (internally) is used to configure the m-control remote control parameters. The A-Net Slots that are controllable from a particular Yamaha device are defined by the Channel/Slot Control DIP switches, which are DIP switches number 1 through 4 on block SW3. This feature allows the user to choose a specific range of the Pro64 network to control from a particular console.

Any combination of the Pro64 Slot banks can be activated for control. Channel/Slot Control settings are independent of the Slot ranges used for A-Net Transmit and A-Net Receive as well as for the individual channel activation settings for audio being sent from the console into the Pro64 network; both groups of settings must be properly configured for successful

console-based control.

- ✓ **NOTE:** The actual number of remote controllable channels is determined by the expansion capability of the particular Yamaha console being used.

The following table shows the parameters that can be changed on DIP switch block SW3.

DIP Switch Block SW3 Functions		
DIP Switch	Parameter	Function
1	Channel/Slot Control 1-16	Activates m-control for 6416m channels 1-16 from the current Yamaha device
2	Channel/Slot Control 17-32	Activates m-control for 6416m channels 17-32 from the current Yamaha device
3	Channel/Slot Control 33-48	Activates m-control for 6416m channels 33-48 from the current Yamaha device
4	Channel/Slot Control 49-64	Activates m-control for 6416m channels 49-64 from the current Yamaha device
5	RS-422 Control Source Select (Backplane or DB9 connector)	Selects the source of the Yamaha RS-422 remote control information—directly from the console's backplane connector, or from the DB9 Remote connector (depends on the console)
6	<i>Unused/Reserved</i>	
7	6416m Mic Input Module Control Group assignment	Sets a Control Group (1-4) for the console and 6416Y2 card; allows only mic preamps in the same Control Group to be changed
8		

Note that any combination of switches 1-4 on block SW3 can be used to send control to a specific range of active Pro64 mic preamp channels. This set of DIP switches will typically be set to less than or equal to the total number of channels that the console can support—16 channels on the LS9-16, 32 channels on the LS9-32, 48 channels on the M7CL, and 64 channels on the PM5D.

The table below shows parameters that can be changed on DIP switch block SW3. Remember that any combination of DIP switches 1-4 can be used to allow control to be sent to a specific range of active Pro64 mic preamp channels.

DIP Switch Block SW3 Settings			
DIP Switch	Parameter	Down	Up
1	Channel/Slot Control 1-16	Control off	Control on (1-16)
2	Channel/Slot Control 17-32	Control off	Control on (17-32)
3	Channel/Slot Control 33-48	Control off	Control on (33-48)
4	Channel/Slot Control 49-64	Control off	Control on (49-64)
5	RS-422 Control Source Select	Use backplane connector	Use DB9 Remote connector
6	<i>Unused/Reserved</i>		
7/8	Control Group	<i>See table below</i>	

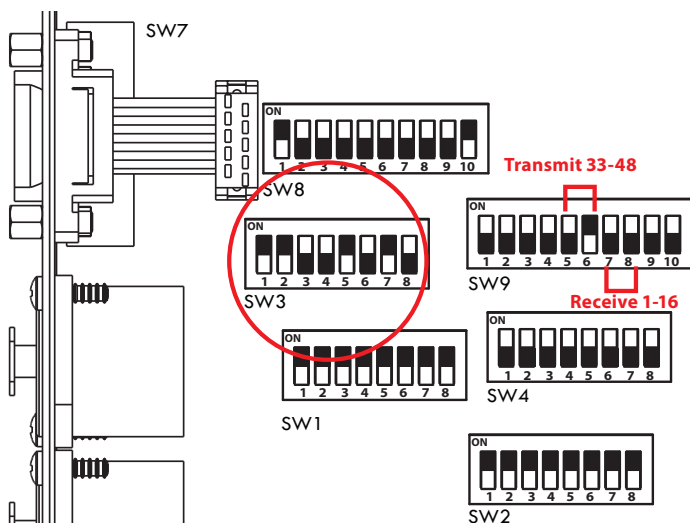
Control Group	DIP Switch 7	DIP Switch 8
1	Down	Down
2	Up	Down
3	Down	Up
4	Up	Up

The Channel/Slot Control settings are separate from the audio I/O setup (including A-Net Transmit and Receive settings). This parameter sets up remote control communications for all 6416Y2 cards installed in the same console. Each 6416Y2 card needs its A-Net Transmit and A-Net Receive range properly configured in order to get the desired results for your application.

The example below shows a 6416Y2 card fully configured for Yamaha remote control and audio I/O.

As seen in DIP switch block SW9, this 6416Y2 card is set to receive channels 1-16 from the Pro64 network (switches 7-8 are down) and to transmit audio from the console into channels/Slots 33-48 of the Pro64 network (switch 5 up, switch 6 down).

A second 6416Y2 card installed in the same console should be set to receive channels 17-32 from the Pro64 network in order to mix all 32 6416m mic preamp channels on the Yamaha console.



This example shows the 6416Y2 DIP switches set to control channels 1-32 of the Pro64 network's 6416m preamps (switches 1-2 up). It uses the rear panel DB9 connector for console remote control communication (switch 5 up), as would be typical for an M7CL or PM5D console. The DIP switch handles are shown in black.

With DIP switch #1 in block SW8 set to the up position as shown, the 6416Y2 will send the remote control commands to the Pro64 mic preamps as RS-422. Use a serial cable to connect the Yamaha console to the 6416Y2 card.

After the card's DIP switches are configured for your application, install the 6416Y2 in the host console and then connect the DB9 cable (if required) to the 6416Y2 card's RS-232/422 jack. Remember to connect the DB9 cable to the one 6416Y2 card that has been configured for m-control console-based remote control in a multi-card system.

Signal Routing to the Console

Routing channels to/from MY expansion cards can be accomplished directly from the Yamaha console's user interface or with a computer using the optional Studio Manager software (available from the Yamaha website at <http://www.yamahaproaudio.com/downloads>). In order to route channels in the console to and from the 6416Y2 cards, be sure that A-Net Transmit and Receive settings on the 6416Y2 cards (Slot range and channel activation) are properly configured.

Clock Settings

Remember that if a Pro64 module other than a 6416Y2 card is used as the network's Control Master, all Yamaha devices need to be set to slave to the external clock provided via A-Net. If a 6416Y2 card is set as the Control Master, all Pro64 devices will slave to the console's clock.

When multiple 6416Y2 cards are installed in a Yamaha host device, only one of the 6416Y2 cards needs to be set as the Pro64 network's Control Master.

When using multiple Yamaha consoles, the second console will need to be set as a slave if a 6416Y2 card in the first console is set to be the Pro64 network Control Master.

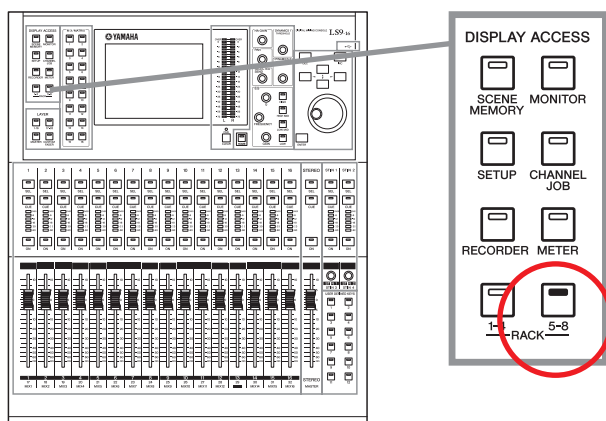
Refer to Yamaha's documentation for more information about clock and sync settings for specific consoles.

Yamaha Console UI Notes

Because the Pro64 network is emulating Yamaha's own remote control protocol, it is important to note that the Yamaha user interface (UI) and its associated display screens will refer to external head amp (HA) devices as "AD8HR" in most cases and never as "Pro64" or "6416m."

LS9 Console Setup

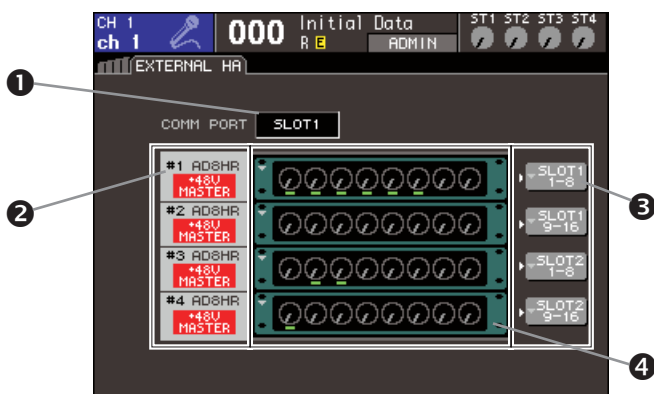
Access to external head amp settings on the LS9 series consoles is available from the Rack 5-8 screens, accessed by repeatedly pressing the **RACK 5-8** button found on the left side of the LS9 top panel until the External HA screen is displayed.



Press the Rack 5-8 button to access the LS9 External HA settings.

External HA Settings on the LS9

The External HA screens on both LS9 series consoles are similar—the LS9-16 will show two groups of eight remote controllable preamps (16 channels total) while the LS9-32 will show four groups (32 channels total). A COMM Port setting is also displayed on each console. (See the diagram below.)



The External HA settings screen on an LS9-32

The LS9 External HA screen includes the following setting:

1. **COMM Port Setting** — Set this to the same MY expansion slot where the 6416Y2 card being used for console remote control is installed. Setting this field to the Off setting (---) will stop all remote control communication. Use the **Dec/Inc** keys to select a port, and then press the **ENTER** key.
2. **Remote Preamps ID** — Available remote controllable preamps are shown in groups of eight channels; note that the device name is always displayed as “AD8HR.” The red “+48V Master” text indicates that the remote AD8HR preamp’s master on/off switch for phantom power is on. The 6416m does not have a separate phantom power master on/off switch, so this parameter will always be on.
3. **Expansion Slot Port Assignment** — Use this field to assign channels of the 6416Y2 card(s) installed in the MY expansion slots to the groups of eight remote mic preamp channels. Each 6416Y2 offers two groups of eight channels, 1-8 and 9-16, at the 44.1/48kHz sample rate.
4. **Virtual Mic Preamps** — This overview shows the current level setting for each remote mic preamp device connected.

Selecting one of the virtual mic preamp fields and then hitting the **ENTER** button on the LS9 will bring up the full size External HA screen that allows all remote controllable parameters to be viewed and edited, displayed in groups of eight channels. The available virtual racks can be selected by choosing one of the numbers at the top of the screen—two virtual racks for the LS9-16 and four virtual racks for the LS9-32. (See below.)



The eight-channel External HA screen shows all controllable parameters.

Only active Pro64 channels on connected 6416m preamps can be edited. Remember that the HPF parameters can only be set to on/off; the high pass filter cutoff frequency parameter does not apply to the 6416m Mic Input Module. The device type will always be displayed as “AD8HR” as Pro64’s m-control is emulating this protocol. All changes made from this screen are instantly transmitted to active 6416m channels on the Pro64 network.

Assigning Remote Preamp Channels to the LS9

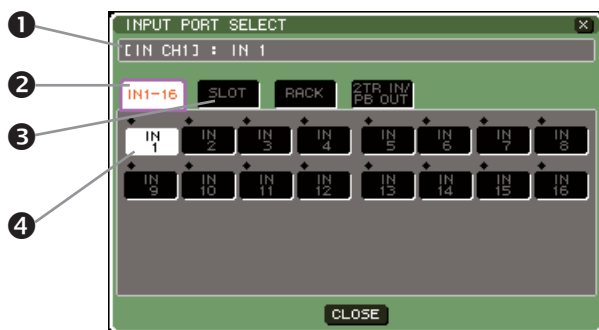
Faders

Each mixer channel on an LS9 can be configured to use any of the console’s available audio resources, including the built-in mic/line inputs on the LS9 rear panel and channels coming into the console via MY expansion slots. The default routings for the LS9-16 have channels 1-16 patched to receive audio from the rear-panel jacks; audio from MY expansion slots defaults to channels 17 and above. The LS9-32 has the first 32 mixer channels patched to receive audio from the rear panel input jacks, with channels 33-64 defaulting to the two MY slots.



The highlighted area of the channel strip screen shows the patching for an external mic preamp from channel #1 of MY expansion slot card #1 to the LS9-32 mixer's fader 33.

Channel strips on the LS9 can be patched individually to create virtually any arrangement of its audio sources. To change a routing, select the current assignment from the channel strip view and press the **ENTER** key to bring up the input port routing page.



Input routing page for the LS9-16

The LS9 input routing port page has the following settings:

1. The currently selected mixer channel being edited
2. The current source of the input to the selected channel—LS9 rear panel input jacks, MY expansion card, etc.
3. To use m-control with the 6416m the input routing source must be set to Slot. Select **SLOT** and then press **ENTER** to use a

channel coming into the console via the 6416Y2 card as the audio source for the channel.

4. Choose a specific input channel from the current input source to be routed to the channel fader on the console. Press **ENTER** to confirm. Press **CLOSE** to exit.

Once correctly patched, changing settings for gain, +48V phantom power, or high pass filter (HPF) on the channel strip will send those commands to the remote 6416m Mic Input Modules via m-control. Scene memories in the console can be used to store and recall these I/O routings and channel mix settings.

M7CL Console Setup

The M7CL comes in two sizes, 32 and 48 channels. Both consoles have three MY expansion slots and can accept up to three 6416Y2 A-Net Interface cards (48 channels total). The M7CL External HA screens will show six groups of eight remote controllable preamps maximum.

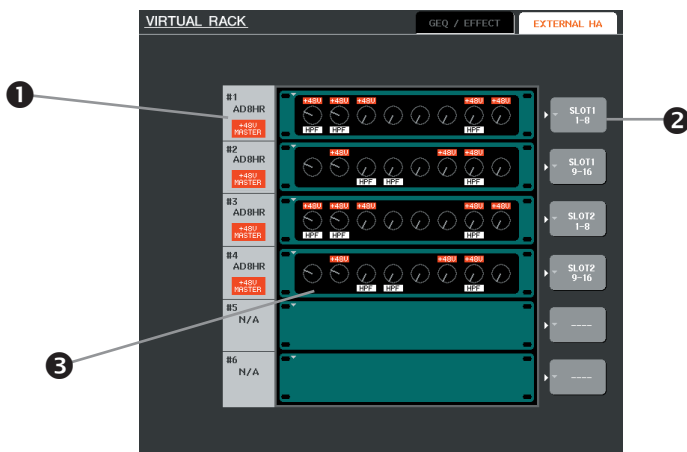
Access to external head amp settings on the M7CL consoles is available from the Virtual Rack window, available by pressing the **RACK** button in the Function Access Area of the console's touchscreen.



The M7CL touchscreen—the circle highlights the button used to access the Virtual Rack screen.

External HA Settings on the M7CL

When the Virtual Rack screen opens, press the **EXTERNAL HA** tab in the upper right corner to display and edit the External HA settings.



External head amp settings shown in the Virtual Rack screen on an M7CL

The M7CL External HA screen includes the following settings:

1. **Remote Preamps ID** — Available remote controllable preamps are shown in groups of eight channels; note that the remote device name is always displayed as “AD8HR.” The red “+48V Master” text indicates that the remote AD8HR preamp’s master on/off switch for phantom power is on. The 6416m does not have a separate phantom power master on/off switch, so this parameter will always be on.
2. **Expansion Slot Port Assignment** — Use this field to assign channels of the 6416Y2 card(s) installed in the MY expansion slots to the groups of eight remote mic preamp channels. Each 6416Y2 offers two groups of eight channels, 1-8 and 9-16, at the 44.1/48kHz sample rate.
3. **Virtual Mic Preamps** — This shows the current level setting for each remote mic preamp device connected. Click on a virtual rack to open the External HA screen.

Clicking one of the virtual preamp fields in the External HA tab of the Virtual Rack screen (see #2 above) will bring up the eight-channel External HA screen for the selected group of eight channels that allows all remote controllable parameters to be viewed and edited.

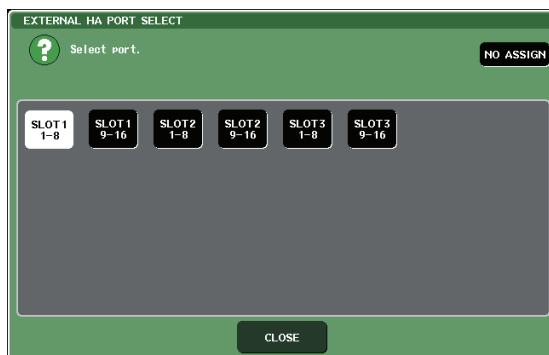
The available virtual preamp racks #1-6 can be selected by choosing one of the six numbers at the bottom of the screen. (See below.) Each virtual rack displays eight channels.



The eight-channel External HA screen on the M7CL shows all controllable parameters in groups of eight.

Only active Pro64 channels on connected 6416m preamps can be edited. Remember that the HPF parameters can only be set to on/off; the high pass filter cutoff frequency parameter does not apply to the 6416m Mic Input Module.

To assign channels from a 6416Y2 A-Net card to the virtual preamp racks, use the External HA Port Select screen which can be accessed by pressing on one of the grey slot assignment blocks. (See the following screen.)



The M7CL External HA Port Select settings

Channels from external head amps are assigned in groups of eight, 1-8 and 9-16. The diagram above shows a console that has three expansion cards installed, for a total of 48 remote controllable channels.

Assigning Remote Preamp Channels to the M7CL

Individual channels on an M7CL can be patched to use any available audio resource, including the console's rear panel mic/line analog inputs or digital audio coming into the console via MY expansion cards.

To change the assignments, first select the overview screen of the channel group you want to change (see below).



The channel overview screen on the M7CL with routing info highlighted

Press the routing and name field of the channel whose assignment you want to change; the Patch/Name popup window will appear (shown below).



The Patch screen allows channels from the external MY card slots to be assigned to the M7CL faders.

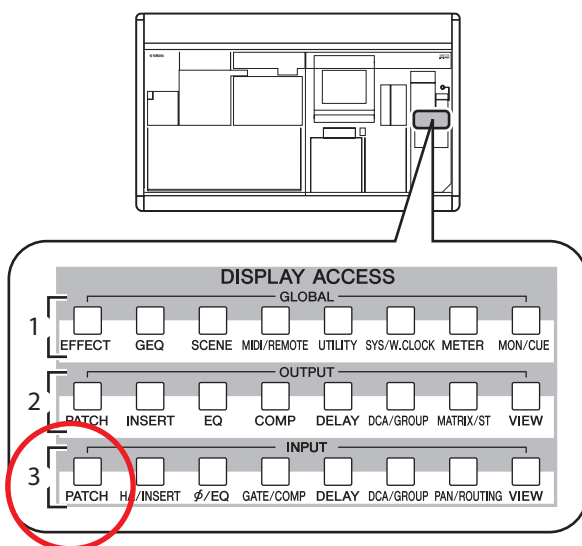
Click on one of the Input Patch assignments to change its source. The diagram above shows console channel #1 getting its audio from the first channel of the first MY expansion slot. Repeat this procedure as needed for any channels that need to be changed.

These Input Patch assignments will save and recall with the M7CL scene memories.

PM5D Console Setup

The PM5D comes in two distinct versions: the PM5D with manual, non-recallable head amp gain controls, and the PM5D-RH that has digital head amp gain controls that are fully programmable. Both versions of the console have four MY expansion slots and can accept up to four 6416Y2 A-Net Interface Cards (64 channels total). The PM5D External HA screens will show eight groups of eight remote controllable preamps maximum.

External head amp settings on the PM5D consoles are available from the Input Patch window. This can be selected from the Display Access section of the PM5D interface.



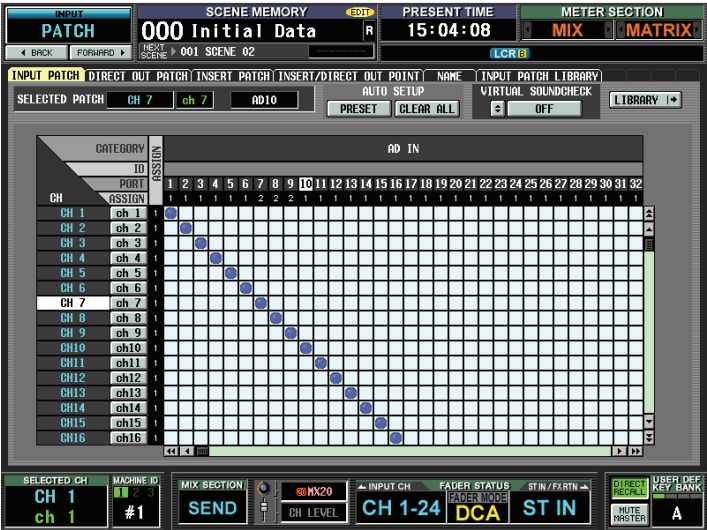
The Display Access area of the PM5D user interface

External HA Settings on the PM5D

Press the **INPUT PATCH** button in the Display Access area of the PM5D to open the patching grid that graphically shows the current input source for each of the console's 48 inputs. Choices include the rear panel mic/line inputs, stereo inputs, and any of the 16 channels from up to four MY expansion cards such as the 6416Y2 installed in the console.

The window scrolls up/down and left/right to accommodate the large amount of patching information available to the operator. The current assignment is shown with a blue dot in the routing display (see the diagram

below). Scroll right to show the expansion slot audio resources.



Input patching is shown as a grid on the PM5D.

Information about the currently selected channel's patching is shown across the top portion of the window (see below).



In this diagram mixer channel #1 is set to receive audio from channel 1 of MY expansion card #1.

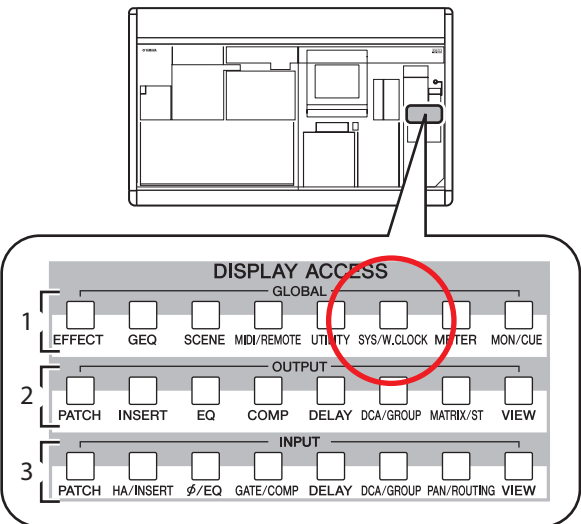
To change the routing for a channel, simply move the cursor to the desired source and click. Depending on the current PM5D preference settings, you may also have to click OK when making a patch change.

Consult the Yamaha documentation for more information on setting user preferences for the PM5D.

Changing 6416m Preamp Settings from the PM5D

Once the individual channels on the PM5D are patched as desired, the 6416m preamp gain, +48V phantom power, and high pass filter (HPF) settings can be

changed as needed via m-control. A global view of the console's 48 channels is available on the HA screen, which is accessed from the System/Word Clock page. Press the **Sys/W.Clock** button in the Display Access section of the PM5D to open it.



To display the External HA settings, click the **Sys/W.Clock** button.

Two External HA screens are available, each displaying four banks of eight channels, for a total of 64 remote controllable channels.



The External HA screen shows all editable parameters.

Click the **EXTERNAL HA 1-4** or **EXTERNAL HA 5-8** button in the display to show the remote preamps (see the detailed view below).



This close-up diagram of the External HA screen shows all editable parameters and routing info.

Console remote control messages sent from the PM5D can control the 6416m's gain, +48V phantom power, and high pass filter only via m-control.

The PM5D's HPF cutoff frequency and the remote preamp +48V Master on/off switch are not supported by the Pro64 preamps.

Other Yamaha Consoles

This document covers setup and use of m-control with the LS9, M7CL, and PM5D consoles. Refer to the documentation that came with your Yamaha console if you need to set up m-control for a DM1000, DM2000, or other host device not covered here.

Remote Control of Yamaha Mic Preamps

Pro64 Virtual Data Cables can be used to send control data from a Yamaha digital console to Yamaha remote-controllable mic preamps such as the AD8HR. The Yamaha devices communicate using RS-422 at a 38.4k baud rate, with 8 data bits, 1 stop bit, and no parity.

Two Pro64 devices with built-in RS-422 capabilities are required to send Yamaha remote control information. The 6416Y2 A-Net Interface Card and the 6416dio Digital I/O Module both have RS-422 capability. (Pro64 devices such as the 6416i Input Module and 6416o Output Module cannot be used in this application; they have only RS-232 connectivity in their VDC I/O sections.)

By connecting the RS-422 port on the Yamaha digital console to the RS-422 port on the 6416Y2 A-Net Interface Card, any changes to gain, +48V phantom power, and high pass filter (HPF) made from the Yamaha control surface will be transmitted to the remote mic preamps via the VDC. Multiple Yamaha mic preamps can be controlled using this method by daisy chaining the RS-422 connections; each preamp is assigned a unique ID and can be addressed separately from within the Yamaha user interface. Note that daisy chaining multiple RS-422 connections requires a specially wired cable, as specified in the Yamaha documentation.

To send remote control data from a Yamaha digital console to a Yamaha digital mic preamp requires a short straight-through DB9 cable (also referred to as a serial cable) to connect the console to the 6416Y2 card. In a straight-through cable, pin 1 is connected to pin 1 on each end of the cable, pin 2 goes to pin 2, etc. A second DB9 cable is used to connect the second Pro64 device's RS-422 VDC port to the Yamaha mic preamps being remote controlled.

- ✓ **NOTE:** Do not use a crossover cable or null modem cable for this application.

Baud Rates

All devices connected in this application need to be set to the same baud rate. Configure the 6416Y2 card's DIP switches before installing it in the Yamaha console; its settings cannot be accessed once the card is installed.

Set up the devices as follows:

RS-422 Port	Baud Rate	Data Bits	Stop Bits	Parity
Yamaha Console	38.4 k	8	1	none
6416Y2 card	38.4 k	8	1	none
Remote Pro64 device	38.4 k	8	1	none

Setting Up

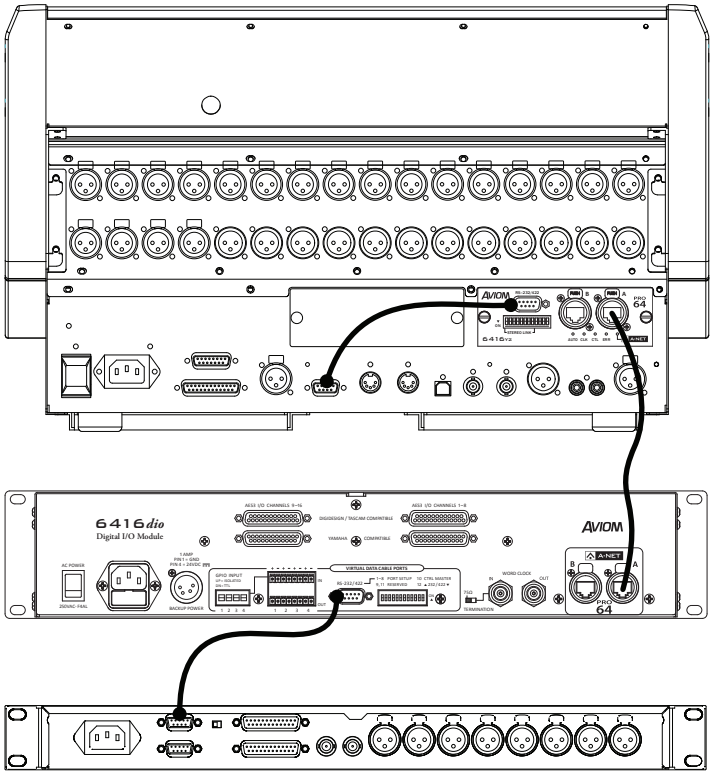
To send remote control data from a Yamaha console to a Yamaha mic preamp with Virtual Data Cables:

1. On the Yamaha digital console, set its RS-422 communication settings for 38.4k baud. (See the documentation that came with your Yamaha product for additional information on changing its control data communication parameters.)
2. Set the 6416Y2 card's baud rate to 38.4k using the DIP switches on the card body. See page 36 for baud rate information.
3. Activate a pair of VDC Slots on the 6416Y2 card, for example, Slots 1 and 2 (an odd-even pair is required).
4. Install the 6416Y2 card in the Yamaha console.
5. Connect a DB9 cable from the RS-422 port on the Yamaha console (labeled "Remote") to the RS-422 port on the 6416Y2 card.
6. Connect the 6416Y2 card to another Pro64 device that has RS-422 capability with a Cat-5e cable (up to 400 feet, 120 meters).
7. On the second Pro64 device, such as the 6416dio Digital I/O Module, set its RS-422 baud rate to 38.4k.
8. Connect its RS-422 port to the first Yamaha mic preamp you want to control with a serial DB9 cable.
9. Connect additional Yamaha mic preamps by daisy chaining the RS-422 connections. This requires a special DB9 cable, as specified in the Yamaha documentation.
10. Power up all the devices.
11. On the Pro64 device receiving the VDC control data, activate the same VDC Slots set up in Step 3 for the 6416Y2 card.

At this point changes to mic pre parameters can be made on the Yamaha control surface.

Consult the documentation that came with your Yamaha product for complete information on routing channels, selecting mic preamps to control, and how to change specific parameters.

Connection Example



This diagram shows a DM1000 console with one 6416Y2 card installed connected to a 6416dio Digital I/O Module and an AD8HR mic preamp.

RS-422 is connected between the console and the 6416Y2 card and between the 6416dio and the AD8HR with DB9 cables. Remote control data travels over a pair of Virtual Data Cables from the console to the remote mic preamp.

RS-232/422 Pinout

The following table shows the pinout of the RS-232/422 jack on the 6416Y2. Note that in the pinout table, some transmit/receive functions (abbreviated as Tx/Rx) are different for RS-232 versus RS-422.

Pin	Function
1	No Connect
2	-Rx (RS-232), -Tx (RS-422)
3	-Tx (RS-232), -Rx (RS-422)
4	+Rx (RS-422)
5	Ground
6	+Tx (RS-422)
7	No Connect
8	No Connect
9	Ground

DB9 cables are available with male-to-male, female-to-female, and male-to-female connectors. Aviom’s RS-232/422 port uses a male DB9 connector and therefore requires a cable with a female connector. The format of the connector at the other end of the cable (male/female) is dependent upon the equipment being connected to. However, connection to other equipment will usually require a female-to-female cable.

There are many different types of DB9 cables available, but Aviom selected a pinout for our DB9 connector that would allow both RS-232 and RS-422 connections to be made with off-the-shelf cables. A “null modem” cable should be used in RS-232 mode. Unfortunately, there are several different types of cables referred to as null modem cables. A true null modem cable crosses pins 2 & 3, 4 & 6, and 7 & 8. Pin 5 will be connected straight through, but pins 1 and 9 will not (though pin 1 will be connected to pin 6 at each end). An example of this type of cable is the L-Com CSNULL9FF-XA (where X = cable length).

An example of the type of null modem cable that should be avoided is the L-Com CSNULL9FF-X (where X = cable length). This is a straight-through cable with the exception of pins 2 and 3, which are crossed.

A true null modem cable is required for the interaction of the RS-422 termination on pin 4 of the connector with the RS-232 signals. On an RS-232 connector, pins 3, 4, and 7 are outputs; pins 1, 2, 6, and 8 are inputs. In a standard null modem cable, pin 4 at one end of the cable will drive pins 1 and 6 at the other end. With a 100 ohm resistor across pins 3 and 4 on the

Aviom DB9 connector, pin 3 (RS-232 –Tx) will drive pins 1 and 6 at the other end of the cable through the 100 ohm resistor. This isn't a problem for most modern RS-232 implementations as these signals are ignored, and both are inputs.

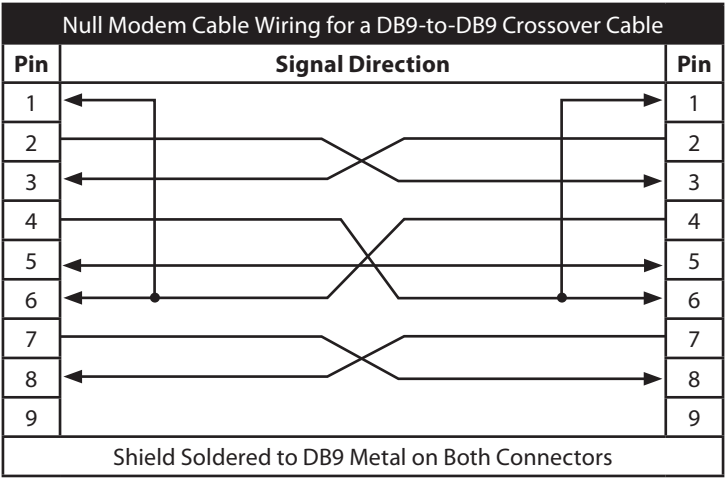
Although there is no standard DB9 pinout for RS-422, the 6416Y2 requires that a straight-through cable be used between the Aviom and Yamaha RS-422 ports. An example of this type of cable is the L-Com CRMN9FF-X (where X = cable length).

If a problem is encountered with the RS-232 operation, there are two things that can be done:

- 1. Try another brand of null modem cable.
- 2. Cut the wire in the cable going to pin 4. It isn't needed for RS-232 operation.

✓ **NOTE** The Aviom RS-232 port does not support the CD, DTR, DSR, RTS, CTS, or RI signals.

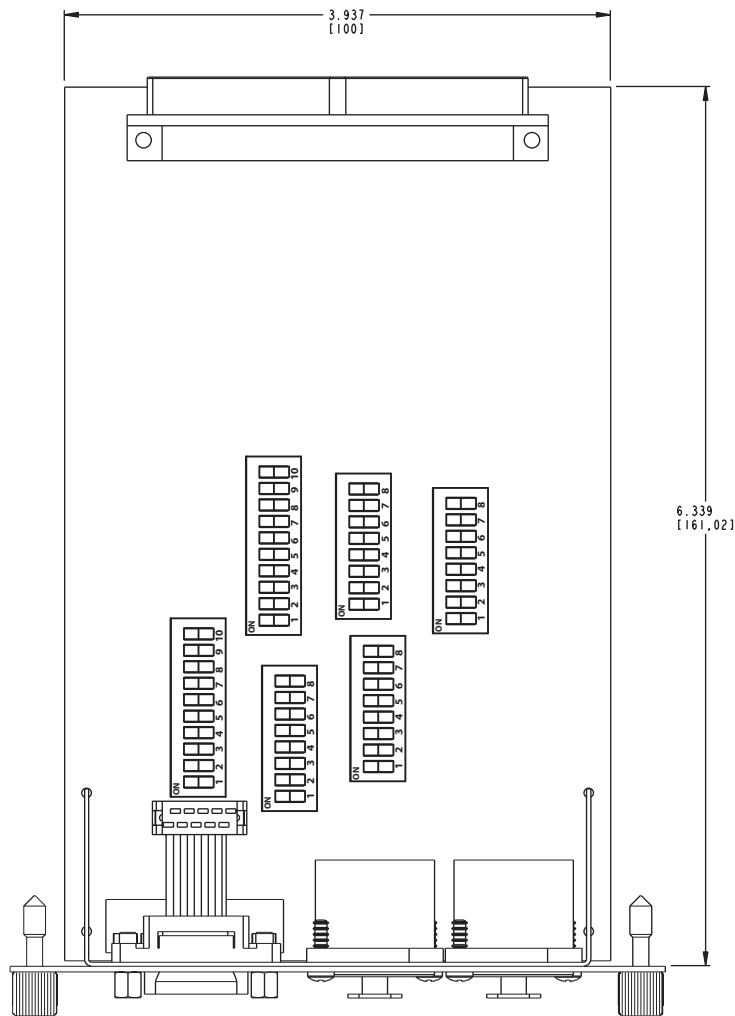
The following table showing the connections for a null modem DB9-to-DB9 crossover cable can be used when making your own cable.

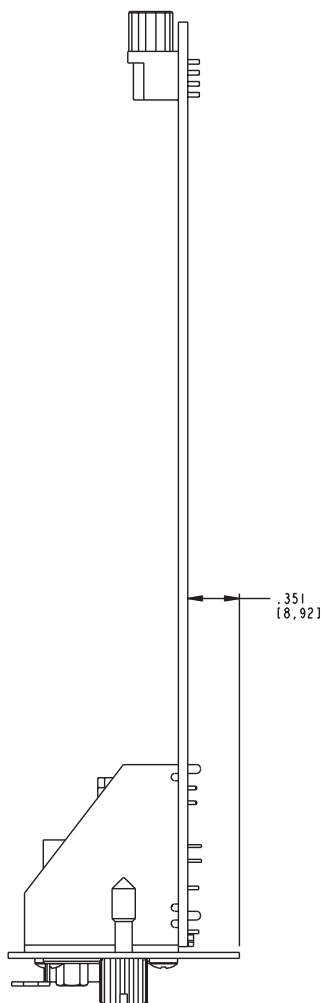
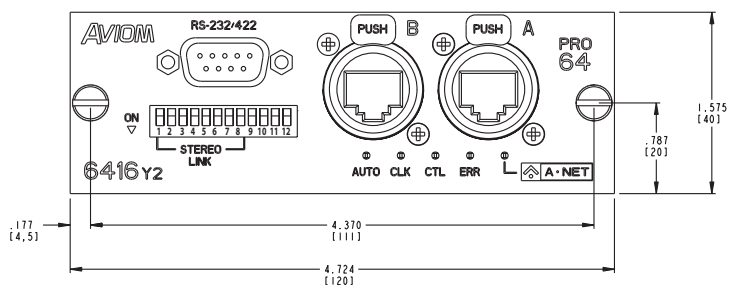


Specifications

Channels	Up to 16 digital inputs and 16 outputs simultaneously	
Interface Format	Yamaha mini-YGDAI (MY) Expansion Card; Supports 8- and 16-channel modes (MY8 and MY16)	
Sample Rate	1x: 44.1, 48kHz 2x: 88.2–96kHz The Pro64 176.4/192kHz sample rates are not supported.	24-bit resolution
Sample Rate Ranges	1x: 39.7–52kHz; 2x: 79.4–104kHz;	
Maximum Ambient Temperature	50°C	
Virtual Data Cables	RS-232/RS-422 DB9 connector; DIP switch configuration	
	Control data from backplane may also be routed to VDCs; DIP switch configuration (Backplane VDC is not supported on all Yamaha digital devices.)	
A-Net	2 EtherCon RJ45 connectors	
A-Net Cable Length	400 feet (120 meters) between Pro64 devices	
Latency	<420µs (measured from Yamaha backplane to AES3 output, through the network)	
Generated Clock Jitter/Wander	1.8ns peak at Clock Master; 50ns peak at a Pro64 device 70 serial connections from the Clock Master (relative to the Clock Master's reference).	
Jitter/Wander Spectrum	Flat above 600Hz; increases 6dB/octave below 600Hz (inaudible due to masking). At the 70th serial connection, increased wander is due to inaudible spectral components below 60Hz.	
Power Supply	+3.3V, +5V, +15V supplied by the Yamaha host device	
Dimensions	4.75" w x 6.25" d x 1.5" h (120.7 x 158.8 x 38.1 mm)	
Weight	0.8 pound (0.36 kg)	
All Aviom products are designed and manufactured in the USA.		

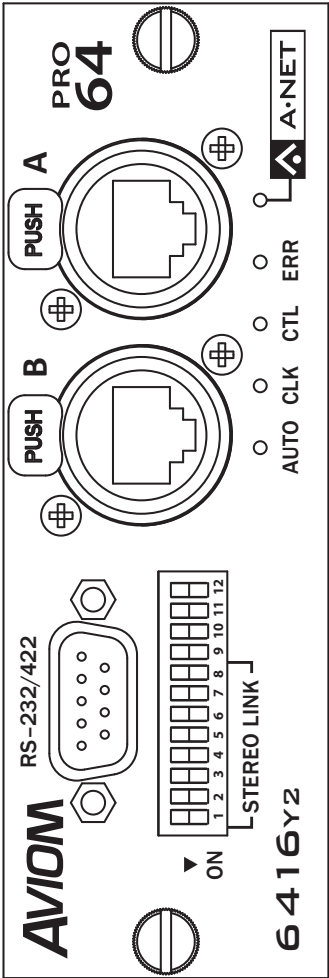
Dimensions





DIP Switch Templates

Use this pair of diagrams to notate settings for the configurations you use frequently. Copy this page to plain paper, enlarging if necessary, and mark DIP switch settings with a pen or marker.



Configuration: _____

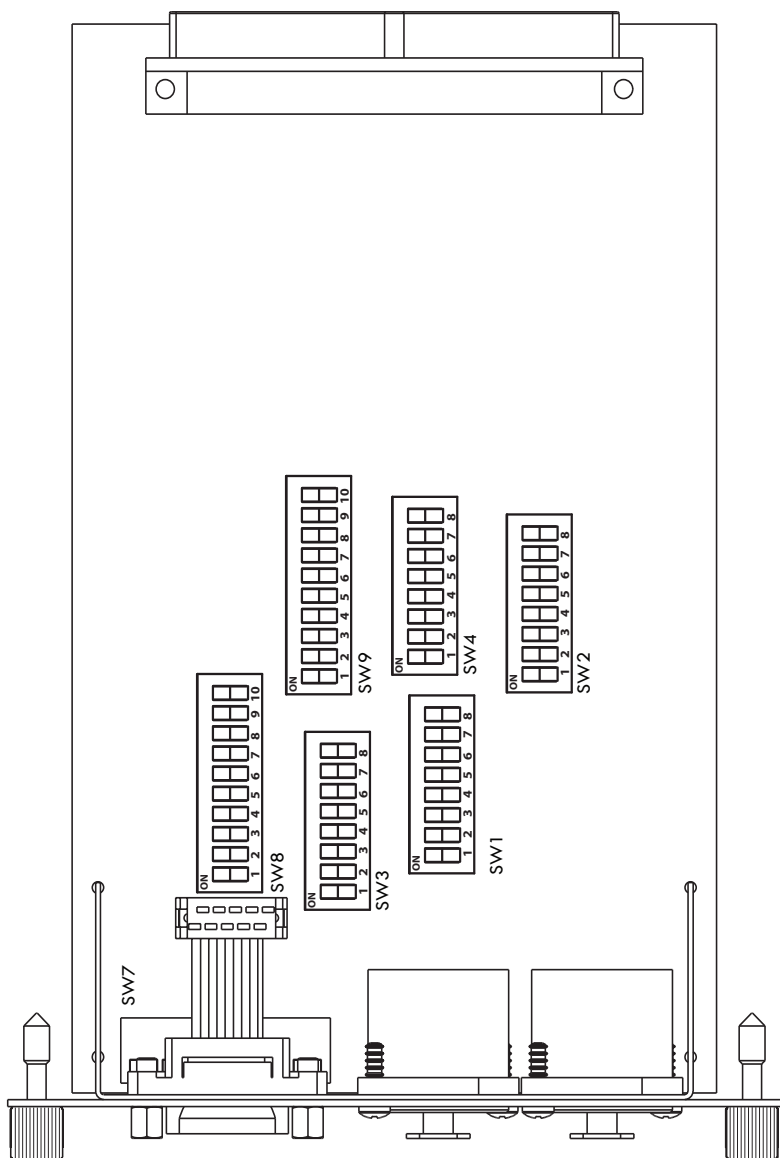
Project Name: _____

Date: _____

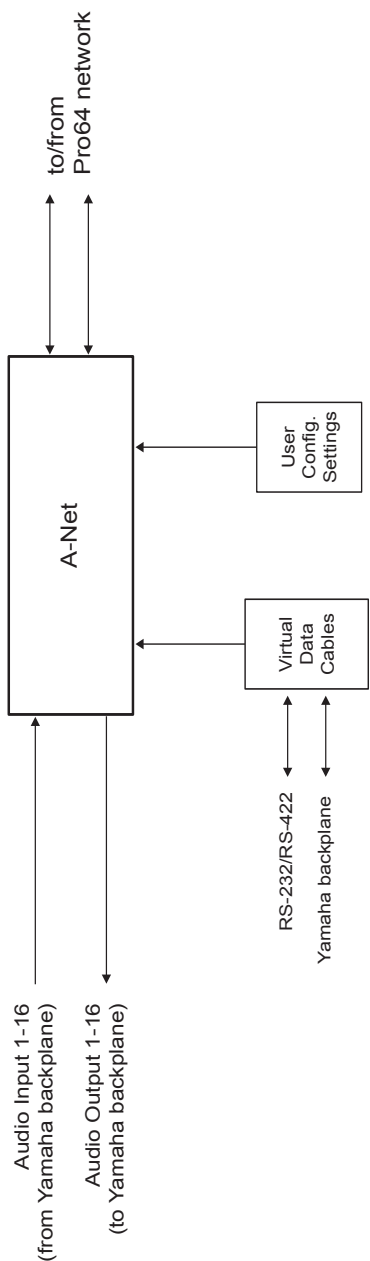
Configuration: _____

Project Name: _____

Date: _____



6416Y2 Block Diagram



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Warranty Registration

Please take a moment to fill in this warranty registration form. Return it to Aviom via mail or fax. All information will be kept confidential.

Model Number _____

Product Serial Number _____

Model Number _____

Product Serial Number _____

Model Number _____

Product Serial Number _____

Model Number _____

Product Serial Number _____

Date Purchased _____

Dealer Name _____

Dealer Location _____

Your Name _____

Address _____

Address _____

City _____

State/Province _____

Zip/Postal Code _____

Country _____

Email Address _____

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